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Electrical Accidents in Mining (1980-85)

**Fatal and Nonfatal Accidents
Underground and on the Surface
at Underground Coal and Metal-
Nonmetal Mines**

By A. Oyler



**U.S. BUREAU OF MINES
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Information Circular 9259

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Electrical Accidents in Mining (1980-85)

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By A. Oyler



**UNITED STATES DEPARTMENT OF THE INTERIOR
Manuel Lujan, Jr., Secretary**

**BUREAU OF MINES
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ELECTRICAL ACCIDENTS IN MINING (1980-85)

Fatal and Nonfatal Accidents Underground and on the Surface at Underground Coal and Metal-Nonmetal Mines

By A. Oyler¹

ABSTRACT

The U.S. Bureau of Mines has compiled data on the major causes of fatal and nonfatal electrical accidents related to mining, and their associated costs, for the 1980-85 period. Specific electrical problem areas were identified, allowing future research to be focused on reducing the frequency of these occurrences. Recommendations for reducing the number of electrical accidents and injuries are provided.

The four mining sectors for which data were gathered and compiled are (1) underground coal mines, (2) surface at underground coal mines, (3) underground metal-nonmetal mines, and (4) surface at underground metal-nonmetal mines. Nine categories of information pertaining to specific aspects of the accident are used in this report: activity engaged in when the accident occurred, source of injury, job title, mining method, location, machine, nature of injury, accident type, and part of body affected. The number of years of experience at the specific job the employee was performing when the accident occurred, time of accident, and in the case of nonfatal accidents, the total days lost per year, are also summarized.

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INTRODUCTION

The data contained in this report were accessed from the Mine Safety and Health Administration (MSHA) accident-injury data base. This data base contains information on all U.S. mine accidents that have occurred since 1972 for coal mines and 1974 for metal-nonmetal mines.

The data base has 50 categories of information pertaining to specific aspects of each accident. Brief definitions of the nine categories selected for use in this report are given in appendix A, along with definitions of nonfatal accidents. Appendix B contains bar charts reflecting the data presented in this report.

The cost information was gathered from an accident cost indicator model (ACIM) (1-2).² The model lists industry-, family-, and public-sector-related costs of the accidents for 1980 through 1985 for each mining sector.

An investigation by MSHA provided information on coal mine electrical fatalities for the 1970-82 period. The information categories used included accident type and location, victim status, controlling company name, system voltage type, district code, date accident occurred, mine

identification code, and accident narrative descriptions. To allow future research to be focused on reducing the frequency of fatal and nonfatal electrical accidents related to mining, the U.S. Bureau of Mines decided to do further work to include the following nine categories of accident information: activities engaged in when the accident occurred, source of injury, job title, mining method, location, machine, nature of injury, accident type, and part of body affected. Data on the number of years of experience at the specific job, time of accident, and total days lost per year for nonfatal accidents were included in the Bureau's analysis.

Other differences between the MSHA investigation and this report include the following: (1) this report deals not only with electrical fatalities but with nonfatal accidents as well, (2) metal-nonmetal mines were included, (3) different categories of information have been accessed from the data base, (4) the data are presented in a different format and bar charts have been added, and (5) the period of time is 1980 through 1985.

ELECTRICAL ACCIDENTS IN UNDERGROUND COAL MINES

Figure 1 is a graphical presentation of electrical accidents in underground coal mines for the 1980-85 period. Observations concerning fatal and nonfatal accidents follow, with the pertinent information relative to each category summarized in tabular form.

FATALITIES

Of 474 total fatalities that occurred in underground coal mines from 1980 through 1985, 32 or 6.8% were electrical in nature (table 1). Nineteen of these incidents occurred while the victim was performing electrical maintenance and repair. The source of injury in most instances was electrical apparatus (13 of 32 cases), followed by conductors, cables, and trolley poles (12 of 32 cases). All victims suffered a fatal electrocution. In 62% of these accidents, the employee had less than 5 years of experience at the specific job being performed when the accident occurred (20 of 32 cases). The average age of the victims was 34.

Tables 2 through 4 summarize the pertinent information relative to the fatal electrical accidents recorded in the 1980-85 period.

NONFATAL ACCIDENTS

Of the 66,995 nonfatal accidents that occurred in underground coal mines from 1980 to 1985, 1,146 or

approximately 2% were electrical in nature (table 5). Electrical repair and maintenance was the activity engaged in 38% of the time when the nonfatal incident occurred (439 of 1,146 cases). The two most common sources of injury were electrical apparatus (478 of 1,146 cases), and conductors, cables, trolley poles (466 of 1,146 cases). Electrical arc burns resulted 53% of the time and the hand was the part of the body most likely to be affected (349 of 1,146 cases). In 64% of these accidents, the employee had less than 5 years of experience at the specific job being performed when the accident occurred (742 of 1,146 cases). The average age of the victims was 35.

Tables 6 through 9 summarize the pertinent information relative to the nonfatal electrical accidents recorded in underground coal mines.

Table 1.—Electrical fatalities versus total fatalities in underground coal mines

Year	Electrical fatalities	Total fatalities
1980	10	94
1981	8	112
1982	4	83
1983	4	44
1984	3	96
1985	3	45
Total	32	474

²Italic numbers in parentheses refer to items in the list of references preceding the appendixes at the end of this report.

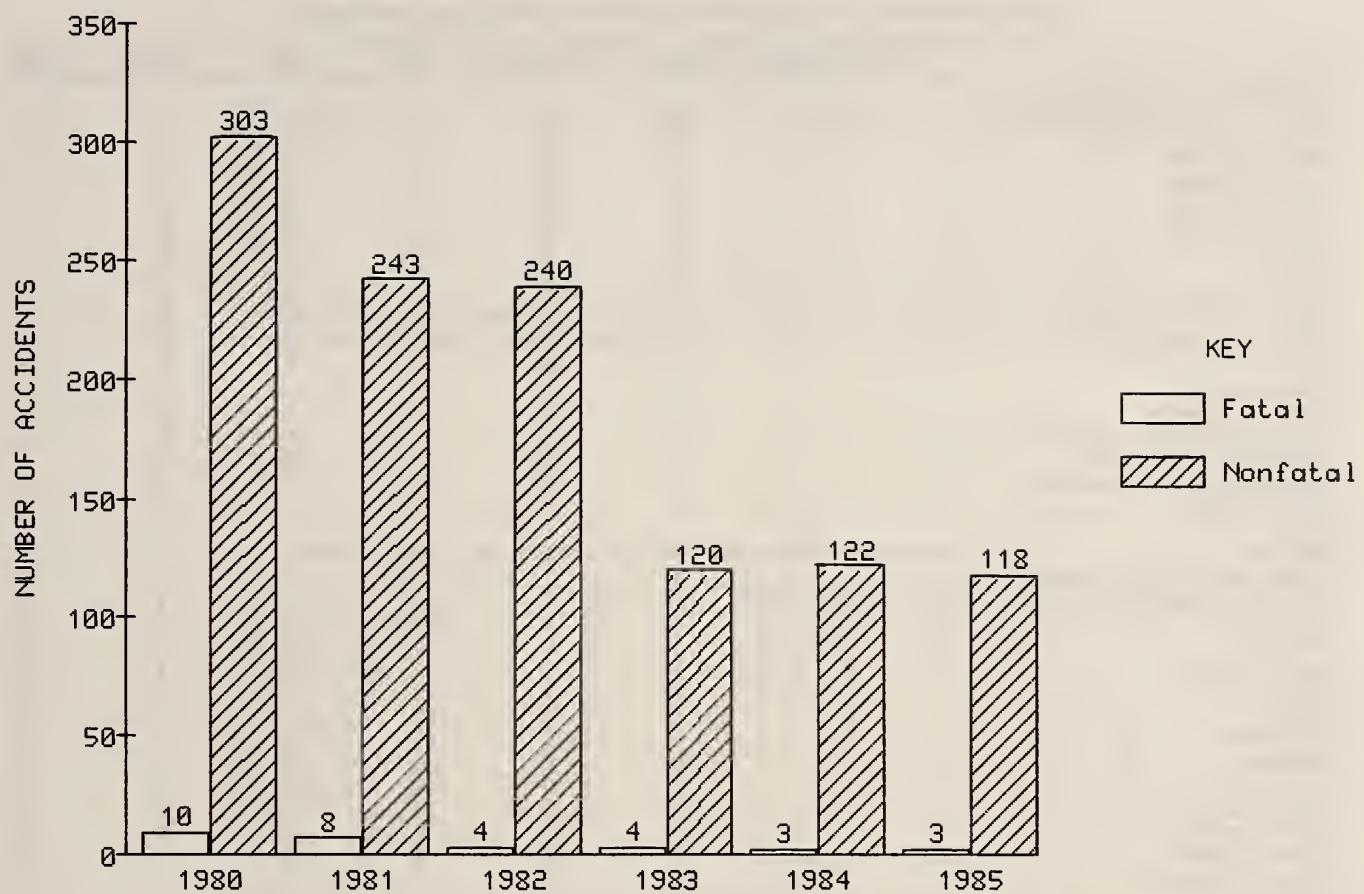


Figure 1.-Fatal and nonfatal electrical accidents in underground coal mines, 1980-85.

Table 2.-Summary of fatal electrical accidents in underground coal mines

	1980	1981	1982	1983	1984	1985	Total
Activity when accident occurred:							
Maintain, repair electrical equipment	3	5	3	3	2	3	19
Handle supplies, material	1	1	0	0	0	0	2
Move power cable	1	1	0	0	0	0	2
Rerail equipment	1	0	0	0	0	0	1
Inspect machinery	1	0	0	0	0	0	1
Drill face, rib, side	1	0	0	0	0	0	1
Walk, run	1	0	0	0	0	0	1
Bolt roof	1	0	0	0	0	0	1
Operate rock dust machine	0	1	0	0	0	0	1
Operate shuttle car operation	0	0	1	0	0	0	1
Inspect mine storage bins	0	0	0	1	0	0	1
Idle	0	0	0	0	1	0	1
Source of injury:							
Electrical apparatus	4	4	2	1	1	1	13
Conductors, cables, trolley poles	5	3	1	1	2	0	12
Transformers, converters	1	0	0	1	0	2	4
Underground mining machines	0	1	0	1	0	0	2
Mine jeep, jitney	0	0	1	0	0	0	1
Job title:							
Electrician	2	2	1	2	0	0	7
Laborer, muck machine operator	1	1	1	0	0	1	4
Maintenance foreman	1	0	1	1	1	0	4
Roof bolter	1	1	0	0	1	0	3
Mechanic	0	1	0	0	0	1	2
Labor foreman	0	0	0	1	0	1	2
Mine foreman	1	0	0	0	1	0	2
Blaster	1	0	0	0	0	0	1
Drill operator	1	0	0	0	0	0	1
Motorman	1	0	0	0	0	0	1
Wireman	1	0	0	0	0	0	1
Section foreman	0	1	0	0	0	0	1
Master electrician	0	1	0	0	0	0	1
Laborer, propman	0	1	0	0	0	0	1
Shuttle car operator	0	0	1	0	0	0	1
Mining method:							
Continuous	7	6	3	1	0	0	17
Conventional-stope	3	1	0	1	2	1	8
Not defined	0	1	1	1	1	1	5
Longwall	0	0	0	1	0	1	2
Location:							
Face	3	4	1	1	1	3	13
Other	6	2	2	1	0	0	11
Intersection	0	2	1	0	2	0	5
Not defined	1	0	0	2	0	0	3
Machine:							
Unknown	3	2	3	2	0	2	12
Roof bolter	2	0	0	0	1	0	3
Continuous miner, tunnel borer	1	2	0	0	0	0	3
Shuttle car	0	2	1	0	0	0	3
Pump	0	0	0	1	1	0	2
Man trip, man car, jeep, personnel carrier, etc	1	0	0	0	0	0	1
Cutting machine (mining only), chain cutter	1	0	0	0	0	0	1
Rock drill, jackleg, jackhammer, drifter, etc	1	0	0	0	0	0	1
Mine car, nipper truck, timber truck (underground only)	1	0	0	0	0	0	1
Rock duster	0	1	0	0	0	0	1
Conveyor, all types; belt feeder	0	1	0	0	0	0	1
Plow shearer, longwall machine	0	0	0	1	0	0	1
Machine, not elsewhere classified	0	0	0	0	1	0	1
Large shop tools: lathe, drill, press, etc	0	0	0	0	0	1	1
Nature of injury:							
Electric shock, electrocution	10	8	4	4	3	3	32
Accident type:							
Electric current	10	8	4	4	3	3	32
Part of body affected: Body systems	10	8	4	4	3	3	32

Table 3.-Years of experience¹ at specific job when fatal electrical accident occurred in underground coal mines

Year	0-5	6-10	11-15	16-20	Over 20
1980	7	2	0	0	1
1981	6	1	0	1	0
1982	3	0	1	0	0
1983	0	4	0	0	0
1984	1	2	0	0	0
1985	3	0	0	0	0
Total	20	9	1	1	1

¹Data do not represent total mining experience of employees, only experience at the specific job being performed when accident occurred.

Table 4.-Times when electrical fatalities occurred in underground coal mines

	1980	1981	1982	1983	1984	1985	Total
11:01 a.m. to 1:01 p.m.	2	0	0	0	0	2	4
1:01 to 3:01 p.m.	2	1	0	0	0	1	4
3:01 to 5:01 p.m.	0	1	0	0	1	0	2
5:01 to 7:01 p.m.	1	0	0	0	0	0	1
7:01 to 9:01 p.m.	0	0	1	0	1	0	2
9:01 to 11:01 p.m.	3	1	0	0	0	0	4
11:01 p.m. to 1:01 a.m.	0	0	0	1	0	0	1
1:01 to 3:01 a.m.	0	1	1	0	1	0	3
3:01 to 5:01 a.m.	0	0	0	1	0	0	1
5:01 to 7:01 a.m.	1	2	1	0	0	0	4
7:01 to 9:01 a.m.	1	1	1	0	0	0	3
9:01 to 11:01 a.m.	0	1	0	0	0	0	1
Unknown	0	0	0	2	0	0	2

NOTE.—From 1980 through 1985, 16 of 30 accidents occurred in the afternoon. In 2 cases, times were not listed and are shown as unknown.

Table 5.-Electrical nonfatal accidents versus total nonfatal accidents in underground coal mines

Year	Electrical nonfatal accidents	Total nonfatal accidents
1980	303	16,398
1981	243	13,257
1982	240	12,610
1983	120	8,172
1984	122	8,740
1985	118	7,818
Total	1,146	66,995

Table 6.—Summary of nonfatal electrical accidents in underground coal mines

	1980	1981	1982	1983	1984	1985	Total
Activity when accident occurred:							
Maintain, repair electrical equipment	118	99	88	53	51	30	439
Handle supplies, material	27	27	40	16	10	8	128
Maintain machine	18	14	14	8	16	15	85
Move power cable	20	14	11	5	7	12	69
Rerail equipment	18	14	16	4	2	6	60
Operate, locomotive	17	0	16	6	0	0	39
Operate, ride man trip	11	6	6	4	4	4	35
Inspect machinery	6	6	11	3	0	9	35
Use handtools	4	3	4	5	5	9	30
Escaping a hazard	10	10	4	3	1	0	28
Use continuous miner	3	5	2	2	5	1	18
Operate shuttle car	4	2	2	1	2	4	15
Operate locomotive	0	8	0	0	4	2	14
Idle	4	3	1	1	3	1	13
Weld, cut	7	0	3	1	1	0	12
Bolt roof	4	3	1	0	2	2	12
Unknown	1	1	5	1	1	1	10
Operate load-haul-dump	2	2	0	0	2	3	9
Bolt roof, insert bolt	2	2	0	1	2	1	8
Walk, run	1	3	1	1	2	0	8
Observe operations	2	3	0	0	1	0	6
Other	2	2	1	0	0	1	6
Ride equipment	4	1	0	0	0	0	5
Use powered handtools	2	2	1	0	0	0	5
Cleanup	0	2	1	2	0	0	5
Handle timber	2	0	1	0	0	1	4
Operate jitney	2	1	1	0	0	0	4
Supervise	2	0	1	0	0	1	4
Operate conveyor belt	2	0	0	0	0	1	3
Operate loading machine	1	1	0	0	0	1	3
Get on-off equipment	0	2	1	0	0	0	3
Hand load	2	0	0	0	0	0	2
Bolt roof, drilling	1	0	1	0	0	0	2
Drill face, rib, side	0	1	1	0	0	0	2
Hang tubes, ropes, wire, pipe	0	1	0	0	0	1	2
Use cutting machine	0	0	1	1	0	0	2
Operate underground equipment	0	1	0	0	0	1	2
Inspect mine storage bins	0	0	2	0	0	0	2
Couple mine cars	0	0	0	1	1	0	2
Move equipment	0	0	1	1	0	0	2
Grinder	1	0	0	0	0	0	1
Handle explosives	1	0	0	0	0	0	1
Lay track, roadbed	1	0	0	0	0	0	1
Sprag, block mine cars	1	0	0	0	0	0	1
Bar down face, roof	0	1	0	0	0	0	1
Caging	0	1	0	0	0	0	1
Cement work	0	1	0	0	0	0	1
Horseplay	0	0	1	0	0	0	1
Bolt roof, tramming	0	0	1	0	0	0	1
Operate rock dust machine	0	1	0	0	0	0	1
Crawling, kneeling	0	0	0	0	0	1	1
Operate longwall equipment	0	0	0	0	0	1	1
Set, relocate pipes	0	0	0	0	0	1	1
Source of injury:							
Electrical apparatus	113	110	108	53	57	37	478
Conductors, cables, trolley poles	132	95	91	46	51	51	466
Flame, fire, smoke	11	11	11	6	3	14	56
Transformers, converters	7	5	5	3	1	3	24
Floor, bottom	8	4	3	2	2	0	19
Underground mining machines	2	1	6	2	2	4	17
Mine jeep, jitney	5	3	3	1	1	1	14
Acids, alkalies (wet cement)	1	4	0	0	1	1	7

Table 6.—Summary of nonfatal electrical accidents in underground coal mines—Continued

	1980	1981	1982	1983	1984	1985	Total
Source of injury—Continued							
Underground narrow-gage railcars	3	0	2	0	0	0	5
Posts, caps, timbers	2	1	0	1	1	0	5
Belt conveyors	0	2	0	0	1	2	5
Metal (pipes, wire, nails, etc.)	3	0	1	0	0	0	4
Apparel	2	0	1	1	0	0	4
Machines, office	1	1	0	1	1	0	4
Side, rib	2	1	0	0	0	0	3
Motors	1	0	2	0	0	0	3
Metal covers, guards, gates, roof bolt plates	1	0	0	1	1	0	3
Pumps, fans, compressors, engines	1	0	2	0	0	0	3
Broken rock, coal waste	2	0	0	0	0	0	2
Explosives	1	0	1	0	0	0	2
Elevators, cages, skips	1	1	0	0	0	0	2
Wrench	0	1	0	0	0	1	2
Noise	0	1	0	0	0	1	2
Back, roof, hanging wall, underground	1	0	1	0	0	0	2
Powered handtools	1	0	0	0	0	0	1
Roof bolts	1	0	0	0	0	0	1
Grinder, polisher, buffer	1	0	0	0	0	0	1
Bodily motion	0	1	0	0	0	0	1
Liquids	0	1	0	0	0	0	1
Power saw	0	0	1	0	0	0	1
Chains, ropes, cables, not conveyor	0	0	1	0	0	0	1
Cribbing	0	0	1	0	0	0	1
Chemicals	0	0	0	1	0	0	1
Handtools (not powered)	0	0	0	1	0	0	1
Nonpowered vehicles	0	0	0	1	0	0	1
Hoisting apparatus	0	0	0	0	0	1	1
Molten metal	0	0	0	0	0	1	1
Forklifts, stackers	0	0	0	0	0	1	1
Job title:							
Mechanic	65	42	34	22	28	23	214
Electrician	46	38	46	28	30	16	204
Laborer, muck machine operator	31	24	16	9	7	7	94
Motorman	27	11	33	9	4	3	87
Shuttle car operator	12	12	10	8	5	10	57
Roof bolter	11	11	12	2	8	6	50
Labor foreman	16	14	10	6	2	2	50
Maintenance foreman	7	11	5	6	4	6	39
Continuous miner operator	8	6	4	4	2	4	28
Continuous miner helper	9	6	2	1	2	5	25
Unknown	5	2	13	2	0	4	26
Scoop car operator	3	10	3	3	2	4	25
Conveyor man	6	4	6	0	2	4	22
Mine foreman	4	5	2	1	2	1	15
Cutting machine operator	3	4	1	0	1	4	13
Master electrician	4	2	5	0	2	0	13
Roof bolt helper	5	2	1	0	2	1	11
Section foreman	1	4	3	0	0	3	11
Wireman	4	3	2	1	1	0	11
Fire boss	1	3	4	2	0	1	11
Trackman	2	4	1	2	1	0	10
Trainee	4	3	2	0	0	0	9
Superintendent	2	2	2	0	0	2	8
Laborer, propman	3	2	3	0	0	2	10
Loading machine operator	1	1	1	1	1	2	7
Rock duster	2	1	1	4	4	0	12
Assistant mine foreman	0	4	1	1	0	0	6
Jackster	1	0	3	0	1	1	6
Pumper	1	2	5	1	0	0	9
Stopping builder	1	3	1	0	0	0	5

Table 6.—Summary of nonfatal electrical accidents in underground coal mines—Continued

	1980	1981	1982	1983	1984	1985	Total
Job title—Continued							
Drill operator	1	0	1	1	1	1	5
Supplyman	0	2	1	0	0	2	5
Rock driller	0	1	0	0	0	0	1
Electrical helper	1	1	1	0	1	0	4
Longwall shear operator	2	0	0	0	1	1	4
Utility man	1	1	1	0	1	0	4
Belt cleaner	2	0	1	0	1	0	4
Blaster	1	0	1	0	0	1	3
Welder, cement man	3	0	0	0	0	0	3
Master mechanic	1	1	1	0	0	0	3
Beltman	2	0	0	1	1	0	4
Brakeman, rope rider	0	0	0	1	1	0	2
Tractor operator	0	0	0	1	1	0	2
Brattice man	0	1	0	0	1	0	2
Jack setter	1	0	0	0	0	0	1
Rodman	1	0	0	0	0	0	1
Boom operator	1	0	0	0	0	0	1
Yard foreman	1	0	0	0	0	0	1
Safety representative	0	0	0	1	0	0	1
Timberman	0	0	0	0	0	1	1
Battery station operator	0	0	1	0	0	0	1
Truck driver	0	0	0	1	0	0	1
Electrical engineer	0	0	0	1	0	0	1
Waterline man	0	0	0	0	1	0	1
Scoop tram operator	0	0	0	0	1	0	1
Transportation trainee	0	0	0	0	0	1	1
Mining method:							
Continuous	192	147	113	70	70	61	653
Not defined	57	55	91	29	33	30	295
Conventional-stope	40	28	26	10	9	13	126
Longwall	6	8	1	8	4	7	34
Other	6	5	7	3	6	7	34
Shortwall	2	0	0	0	0	0	2
Hand	0	0	2	0	0	0	2
Location:							
Other	142	120	88	45	51	47	493
Face	67	42	40	23	21	27	220
Not defined	38	36	67	29	22	26	218
Intersection	37	34	29	19	21	13	153
Shop	8	4	8	2	5	1	28
Vertical shaft	7	4	4	1	2	4	22
Inclined shaft	4	3	4	1	0	0	12
Nature of injury:							
Electrical arc burn	164	134	124	53	78	60	613
Electrical burn (contact burn)	54	43	51	39	17	17	221
Electrical shock (electrocution)	38	29	44	10	14	22	157
Burn or scald (heat)	6	3	6	4	2	11	32
Multiple injuries	10	7	2	3	4	1	27
Asphyxia	5	9	5	2	1	5	27
Bruise	10	2	2	1	0	0	15
Sprain, strain	3	6	2	1	3	0	15
Chemical burns	2	4	0	2	1	1	10
Laceration, cut, puncture	4	2	0	1	0	0	7
Unclassified, not determined	2	0	1	1	1	1	6
Fracture	2	1	1	1	0	0	5
Poisoning	1	1	0	1	1	0	4
Dislocation	1	1	1	0	0	0	3
Scratches, abrasions	1	0	0	0	0	0	1
Hearing loss or impairment	0	1	0	0	0	0	1
Dust in eyes	0	0	1	0	0	0	1
Other	0	0	0	1	0	0	1

Table 6.—Summary of nonfatal electrical accidents in underground coal mines—Continued

	1980	1981	1982	1983	1984	1985	Total
Accident type:							
Flash burns, electric	176	136	122	51	79	60	624
Electric current	83	74	97	52	32	40	378
Contact with hot substance	9	3	6	5	3	11	37
Inhalation of toxics	6	11	5	3	3	5	33
Fall from machine	8	5	2	1	2	0	18
Struck against stationary object	3	3	3	1	0	0	10
Absorption of toxics	1	3	0	2	1	1	8
Struck, not elsewhere classified	4	1	1	0	1	0	7
Struck by flying object	2	1	1	1	1	0	6
Struck against moving object	3	2	0	0	0	0	5
Fall against object	3	0	0	2	0	0	5
Fall to working surface	1	1	1	1	0	0	4
Unknown	1	1	0	0	0	1	3
Struck by falling object	2	0	0	0	0	0	2
Overexertion	1	0	1	0	0	0	2
Bodily reaction	0	2	0	0	0	0	2
Flash burns, welding	0	0	1	0	0	0	1
Caught in moving stationary object	0	0	0	1	0	0	1
Part of body:							
Hand	92	75	79	34	33	36	349
Body systems	44	39	49	13	16	27	188
Multiple injuries	38	40	33	25	23	17	176
Eyes	52	29	27	15	12	11	146
Fingers	15	13	16	10	14	6	74
Upper extremities, multiple	9	9	8	11	6	11	54
Wrist	3	5	3	0	4	1	16
Leg	7	2	2	1	1	2	15
Arm	5	1	3	4	2	0	15
Face, multiple parts	4	5	1	0	2	2	14
Face	3	4	2	1	2	2	14
Forearm	6	2	0	2	1	2	13
Back	6	4	0	0	1	0	11
Head, multiple parts	4	2	3	0	0	0	9
Knee	2	4	2	0	1	0	9
Shoulders	4	2	2	0	0	0	8
Elbow	3	0	2	2	0	0	7
Neck	1	1	1	0	2	0	5
Head	1	1	2	1	0	0	5
Thigh	0	1	1	0	1	0	3
Nose	1	1	0	0	0	0	2
Internal ear	0	1	0	0	0	1	2
Ankle	0	0	1	0	1	0	2
Lower leg	1	0	0	0	0	0	1
Hips	1	0	0	0	0	0	1
Chest	1	0	0	0	0	0	1
Trunk, multiple injuries	0	1	0	0	0	0	1
Lower leg	0	1	0	0	0	0	1
Upper arm	0	0	1	0	0	0	1
Leg, multiple injuries	0	0	1	0	0	0	1
Body parts	0	0	1	0	0	0	1
Unclassified	0	0	0	1	0	0	1

Table 7.—Years of experience¹ at specific job when nonfatal electrical accident occurred in underground coal mines

Year	0-5	6-10	11-15	16-20	Over 20	Unknown
1980	228	44	13	3	8	7
1981	170	51	8	1	6	7
1982	147	52	15	2	5	19
1983	69	36	2	0	0	13
1984	58	41	8	3	0	12
1985	70	32	9	2	0	5
Total	742	256	55	11	19	63

¹Data do not represent total mining experience of employees, only experience at the specific job being performed when accident occurred.

Table 8.—Times when electrical nonfatal accidents occurred in underground coal mines

	1980	1981	1982	1983	1984	1985	Total
11:01 a.m. to 1:01 p.m.	22	20	20	7	6	5	80
1:01 to 3:01 p.m.	28	25	24	9	12	12	110
3:01 to 5:01 p.m.	31	21	18	9	7	7	93
5:01 to 7:01 p.m.	30	15	21	16	14	15	111
7:01 to 9:01 p.m.	21	19	19	11	10	9	89
9:01 to 11:01 p.m.	18	21	17	4	8	8	76
11:01 p.m. to 1:01 a.m.	23	18	18	5	4	6	74
1:01 to 3:01 a.m.	19	13	27	13	14	13	99
3:01 to 5:01 a.m.	23	22	18	11	10	10	94
5:01 to 7:01 a.m.	22	15	12	9	11	10	79
7:01 to 9:01 a.m.	30	21	19	15	9	10	104
9:01 to 11:01 a.m.	28	28	19	9	9	8	101
Unknown	8	5	8	2	8	5	36

NOTE.—From 1980 through 1985, 589 of 1,110 accidents occurred in the a.m. In 36 cases, the times were not listed and are shown here as unknown.

Table 9.—Total days lost per year as a result of nonfatal electrical accidents in underground coal mines

Year	Accidents	Days lost
1980	303	4,169
1981	243	3,146
1982	240	3,541
1983	120	2,226
1984	122	4,302
1985	118	1,925
Total	1,146	19,309

ELECTRICAL ACCIDENTS AT THE SURFACE AT UNDERGROUND COAL MINES

Figure 2 is a graphical presentation of fatal and nonfatal electrical accidents at the surface at underground coal mines including associated shops, yards, and tipples when located at the mine.

FATALITIES

Of the 45 total fatalities that occurred at the surface at underground coal mines including associated shops, yards, and tipples when located at the mine, 8 or 18% were electrical as shown in table 10. Five of these incidents occurred while the victim was performing electrical maintenance and repair. The source of injury in most instances was electrical apparatus (five of eight cases). All victims suffered a fatal electrocution. In three of the cases, the employee had less than 5 years of experience at the specific job being performed when the accident occurred. In three cases, the employee had from 11 to 15 years of experience at that specific job. The average age of the victims was 37.

Tables 11 through 13 summarize the pertinent information relative to the fatal accidents recorded at the surface at underground coal mines.

NONFATAL ACCIDENTS

Of the 5,489 nonfatal accidents that occurred at the surface at underground coal mines, 125 or 2.3% were electrical in nature as shown in table 14. Electrical repair

and maintenance was the activity most commonly engaged in when the nonfatal incident occurred (69 of 125 cases). In 67 of 125 cases, the source of injury was electrical apparatus and in 24 of 125 cases, conductors, cables, and trolley poles were the source. Electrical arc burns resulted in 62 of 125 cases with the hands being the part of the body most subject to injury. Mechanics and electricians led in the number of nonfatal electrical injuries incurred during this time period, with the most frequently injured part of the body being the hand. In almost 50% of these accidents, the employee had less than 5 years of experience at the specific job being performed when the accident occurred (63 of 125 cases). The average age of the victims was 37.

Tables 15 through 18 summarize the pertinent information relative to nonfatal accidents at the surface at underground coal mines.

Table 10.—Electrical fatalities versus total fatalities at the surface at underground coal mines

Year	Electrical fatalities	Total fatalities
1980	0	8
1981	1	9
1982	2	12
1983	2	7
1984	1	2
1985	2	7
Total	8	45

Table 11.—Summary of fatal electrical accidents at the surface at underground coal mines

	1980	1981	1982	1983	1984	1985	Total
Activity when accident occurred:							
Maintain, repair electrical equipment	0	1	1	1	1	1	5
Handle supplies, material	0	0	0	1	0	0	1
Maintain machine	0	0	0	0	0	1	1
Getting on-off equipment	0	0	1	0	0	0	1
Source of injury:							
Electrical apparatus	0	1	1	1	1	1	5
Conductors, cables, trolley poles	0	0	1	0	0	1	2
Transformers, converters	0	0	0	1	0	0	1
Job title:							
Electrician	0	1	1	0	0	0	2
Mechanic	0	0	0	0	1	1	2
Master electrician	0	0	0	1	0	0	1
Mine foreman	0	0	0	0	0	1	1
Truck driver	0	0	1	0	0	0	1
Tipple operator	0	0	0	1	0	0	1
Machine:							
Not recorded in MSHA data base	0	0	1	1	1	1	4
Machine, not elsewhere classified	0	1	0	1	0	0	2
Fan	0	0	0	0	0	1	1
Ore haulage truck, off-highway	0	0	1	0	0	0	1
Nature of injury: Electric shock, electrocution	0	1	2	2	1	2	8
Accident type: Electric current	0	1	2	2	1	2	8
Part of body: Body systems	0	1	2	2	1	2	8

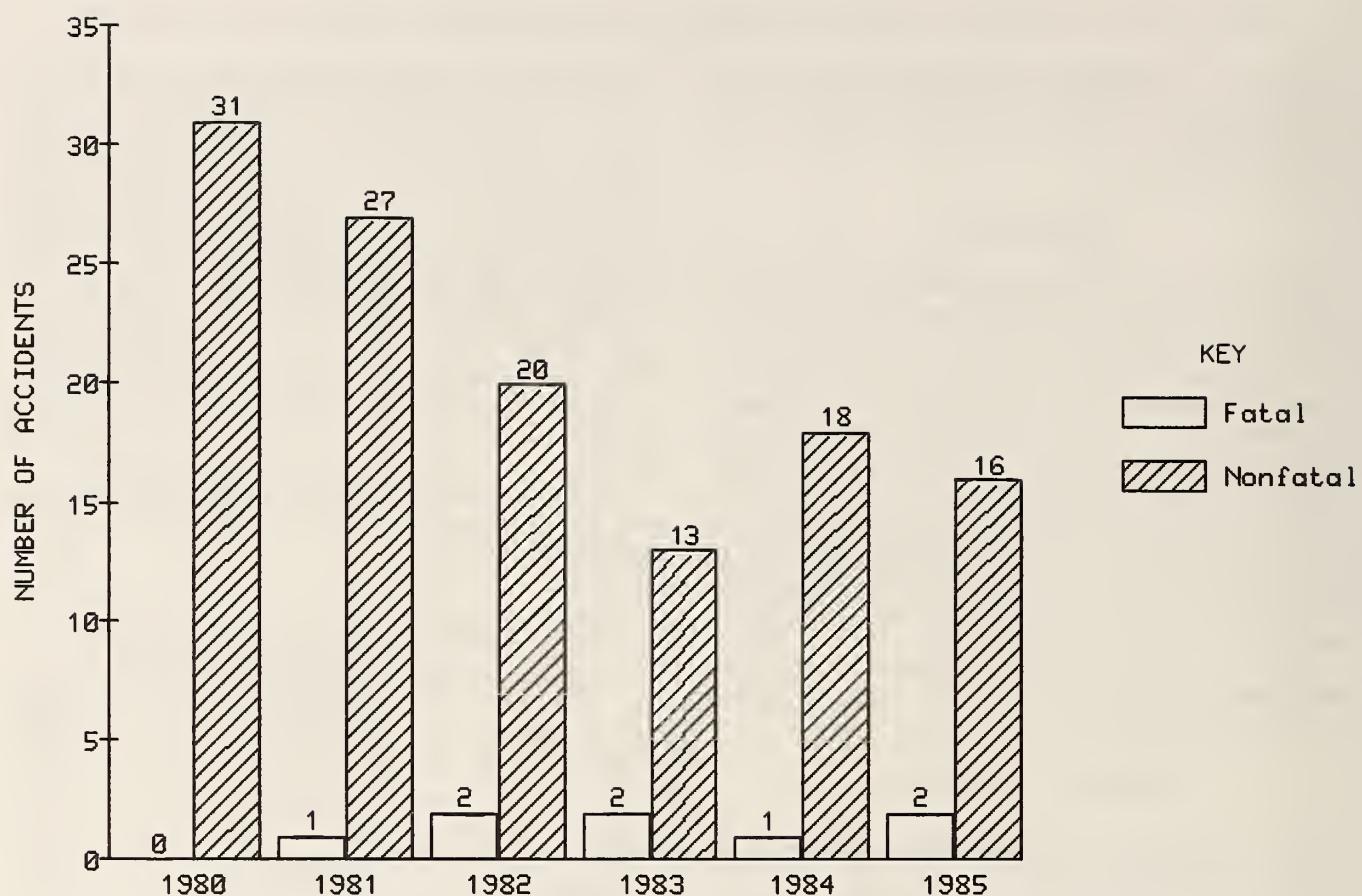


Figure 2.-Fatal and nonfatal electrical accidents at the surface at underground coal mines, 1980-85.

Table 12.—Years of experience¹ at specific job when fatal accident occurred at the surface at underground coal mines

Year	0-5	6-10	11-15	16-20	Over 20
1980	0	0	0	0	0
1981	1	0	0	0	0
1982	0	0	1	1	0
1983	1	0	1	0	0
1984	1	0	0	0	0
1985	0	0	1	0	1
Total	3	0	3	1	1

¹Data do not represent total mining experience of employees, only experience at the specific job being performed when accident occurred.

Table 13.—Times when electrical fatalities occurred at the surface at underground coal mines

	1980	1981	1982	1983	1984	1985	Total
11:01 a.m. to 1:01 p.m.	0	0	0	0	1	0	1
1:01 to 3:01 p.m.	0	0	0	0	0	1	1
3:01 to 5:01 p.m.	0	0	0	0	0	0	0
5:01 to 7:01 p.m.	0	0	0	0	0	0	0
7:01 to 9:01 p.m.	0	1	0	0	0	0	1
9:01 to 11:01 p.m.	0	0	0	0	0	0	0
11:01 p.m. to 1:01 a.m.	0	0	0	2	0	0	2
1:01 to 3:01 a.m.	0	0	0	0	0	0	0
3:01 to 5:01 a.m.	0	0	0	0	0	0	0
5:01 to 7:01 a.m.	0	0	0	0	0	1	1
7:01 to 9:01 a.m.	0	0	2	0	0	0	2
9:01 to 11:01 a.m.	0	0	0	0	0	0	0
Unknown	0	0	0	0	0	0	0

NOTE.—From 1980 through 1985, 6 of 8 accidents occurred in the afternoon.

Table 14.—Electrical nonfatal accidents versus total nonfatal accidents at the surface at underground coal mines

Year	Electrical nonfatal accidents	Total nonfatal accidents
1980	31	1,400
1981	27	1,124
1982	20	1,018
1983	13	617
1984	18	693
1985	16	637
Total	125	5,489

Table 15.—Summary of nonfatal electrical accidents at the surface at underground coal mines

	1980	1981	1982	1983	1984	1985	Total
Activity when accident occurred:							
Maintain, repair electrical equipment	19	16	6	8	12	8	69
Maintain machine	7	1	5	1	1	0	15
Handle supplies, material	1	3	4	0	2	2	12
Use handtools	0	2	0	0	1	2	5
Rerail equipment	2	0	2	0	0	0	4
Operate locomotive	1	1	0	0	0	1	3
Inspect machinery	0	0	0	0	0	2	2
Move power cable	0	1	0	0	1	0	2
Operate surface equipment	0	0	1	1	0	0	2
Idle	0	0	0	0	0	1	1
Escaping a hazard	0	0	0	0	1	0	1
Cleanup	0	0	0	1	0	0	1
Operate mill equipment	0	0	0	1	0	0	1
Operate power shovel	0	0	0	1	0	0	1
Operate jitney	0	1	0	0	0	0	1
Weld, cut	0	0	1	0	0	0	1
Walk, run	0	0	1	0	0	0	1
Move equipment	0	1	0	0	0	0	1
Use powered handtools	1	0	0	0	0	0	1
Not defined	0	1	0	0	0	0	1
Source of injury:							
Electrical apparatus	12	17	10	6	11	11	67
Conductors, cables, trolley poles	9	6	2	2	3	2	24
Acids, alkalies (wet cement)	2	1	2	1	0	0	6
Ground (surface)	1	1	0	0	2	1	5
Flame, fire, smoke	0	1	2	1	0	0	4
Transformers, converters	1	0	1	0	0	1	3
Underground narrow-gage railcars	0	1	0	0	0	1	2
Motors	2	0	0	0	0	0	2
Mine jeep, jitney	2	0	0	0	0	0	2
Metal (pipe, wire, nails, etc.)	1	0	1	0	0	0	2
Surface mining machines	1	0	0	0	0	0	1
Generators	0	0	1	0	0	0	1
Noxious gases, not elsewhere classified	0	0	0	1	0	0	1
Cranes, derricks	0	0	0	1	0	0	1
Space heaters	0	0	0	1	0	0	1
Passenger cars, trucks	0	0	0	0	1	0	1
Metal covers, guards, gates, roof bolt plates	0	0	0	0	1	0	1
Machines, not elsewhere classified, office machines	0	0	1	0	0	0	1
Job title:							
Mechanic	13	2	3	3	3	5	29
Electrician	5	4	5	1	5	5	25
Laborer	3	2	4	3	3	2	17
Maintenance foreman	1	3	0	1	2	0	7
Mine foreman	1	4	0	0	0	0	5
Motorman	0	2	1	1	0	1	5
Unknown	1	3	0	0	1	0	5
Shuttle car operator	0	2	1	0	1	0	4
Superintendent	3	0	0	0	0	0	3
Master electrician	0	0	0	1	1	1	3
Outside foreman	0	2	0	0	0	0	2
Communications repair	0	1	0	0	1	0	2
Roof bolter	0	1	1	0	0	0	2
Labor foreman	0	0	2	0	0	0	2
Drill helper	0	0	2	0	0	0	2
Inspector	0	0	0	0	1	1	2
Brattice man	1	0	0	0	0	0	1
Machinist	1	0	0	0	0	0	1
Fire boss	1	0	0	0	0	0	1
Belt man	0	1	0	0	0	0	1
Welder	0	0	1	0	0	0	1
Loading machine operator	0	0	0	1	0	0	1
Electrical engineer	0	0	0	1	0	0	1
Scoop car operator	0	0	0	1	0	0	1
Trackman	0	0	0	0	0	1	1
Truck driver	1	0	0	0	0	0	1
Machine:							
Not recorded in MSHA data base	16	12	9	4	12	9	62
Locomotive, rail-mounted; lorry car	4	3	4	2	0	2	15

Table 15.—Summary of nonfatal electrical accidents at the surface at underground coal mines—Continued

	1980	1981	1982	1983	1984	1985	Total
Machine—Continued							
Nonpowered handtools	3	5	1	0	1	0	10
Man trip, man car, jeep, personnel carrier, etc.	4	2	1	0	0	0	7
Conveyor, all types; belt feeder	0	2	0	1	0	2	5
Machine, not elsewhere classified	0	0	0	2	1	1	4
Front-end loader, tractor-shovel, highlift, skip-loader, etc.	2	0	1	0	0	0	3
Load-haul-dump, scoop, tram, ram car, etc.	0	0	1	1	1	0	3
Welder	0	1	1	0	1	0	3
Powered handtools	1	1	0	0	0	0	2
Crane, derrick	0	0	0	2	0	0	2
Service truck, pickup truck (not ore haulage)	0	0	0	1	1	0	2
Rock duster	1	0	0	0	0	0	1
Continuous miner, tunnel borer	0	1	0	0	0	0	1
Fan	0	0	1	0	0	0	1
Jumbo carriage-mounted drills on rails, tracks, tires	0	0	1	0	0	0	1
Compressor	0	0	0	0	0	1	1
Pump	0	0	0	0	1	0	1
Cutting machine mining only, chain cutter	0	0	0	0	0	1	1
Nature of injury:							
Electrical arc burn	12	17	10	6	9	9	63
Electrical burn (contact burn)	8	4	1	0	4	4	21
Electrical shock (electrocution)	5	1	3	2	1	2	14
Chemical burn	2	1	2	1	0	0	6
Burn or scald (heat)	0	2	3	1	0	0	6
Multiple injuries	0	1	0	1	2	0	4
Laceration, cut, puncture	1	0	1	1	1	0	4
Sprain, strain	1	1	0	0	0	0	2
Bruise	0	0	0	0	1	0	1
Poisoning	0	0	0	1	0	0	1
Dust in eyes	1	0	0	0	0	0	1
Fracture	1*	0	0	0	0	0	1
Unclassified	0	0	0	0	0	1	1
Accident type:							
Flash burns, electric	12	17	8	6	9	9	61
Electric current	13	5	4	3	6	6	37
Absorption of toxics	2	1	2	1	0	0	6
Contact with hot substance	0	2	3	1	0	0	6
Struck against stationary object	1	1	0	0	0	0	2
Fall from ladder	0	1	0	0	0	1	2
Struck by flying object	1	0	0	1	0	0	2
Fall from machine	0	0	0	0	2	0	2
Caught in, under, or between a moving and a stationary object	1	0	0	0	0	0	1
Fall to working surface	1	0	0	0	0	0	1
Flash burns, welding	0	0	1	0	0	0	1
Fall down raise, shaft	0	0	1	0	0	0	1
Struck by, not elsewhere classified	0	0	1	0	0	0	1
Inhalation of toxics	0	0	0	1	0	0	1
Fall against object	0	0	0	0	1	0	1
Part of body:							
Hand	7	9	6	2	2	5	31
Multiple injuries	6	6	5	1	4	4	26
Eyes	4	5	3	2	1	2	17
Body systems	5	1	3	3	1	2	15
Upper extremities, multiple	2	0	2	2	4	1	11
Fingers	1	1	0	0	3	1	6
Arm	1	1	0	2	1	0	5
Back	0	1	0	0	1	1	3
Wrist	1	1	0	0	0	0	2
Face	2	0	0	0	0	0	2
Forearm	0	2	0	0	0	0	2
Leg	1	0	0	0	0	0	1
Ankle	1	0	0	0	0	0	1
Head	0	0	1	0	0	0	1
Nose	0	0	0	1	0	0	1
Knee	0	0	0	0	1	0	1

Table 16.—Years of experience¹ at specific job when nonfatal electrical accident occurred at the surface at underground coal mines

Year	0-5	6-10	11-15	16-20	Over 20	Not listed
1980	15	10	2	0	1	3
1981	14	7	1	1	1	3
1982	12	3	1	1	1	2
1983	5	7	1	0	0	0
1984	9	4	4	1	0	0
1985	8	3	2	1	0	2
Total	63	34	11	4	3	10

¹Data do not represent total mining experience of employees, only experience at the specific job being performed when accident occurred.

Table 17.—Times when electrical nonfatal accidents occurred at the surface at underground coal mines

	1980	1981	1982	1983	1984	1985	Total
11:01 a.m. to 1:01 p.m.	2	5	6	2	2	1	18
1:01 to 3:01 p.m.	7	5	3	1	3	0	19
3:01 to 5:01 p.m.	4	3	1	0	2	4	14
5:01 to 7:01 p.m.	3	1	1	0	2	2	9
7:01 to 9:01 p.m.	2	1	0	2	0	2	7
9:01 to 11:01 p.m.	2	2	0	0	1	1	6
11:01 p.m. to 1:01 a.m.	1	0	0	1	1	0	3
1:01 to 3:01 a.m.	0	0	4	1	0	0	5
3:01 to 5:01 a.m.	0	1	2	0	2	0	5
5:01 to 7:01 a.m.	1	2	1	1	1	2	8
7:01 to 9:01 a.m.	4	3	2	3	1	3	16
9:01 to 11:01 a.m.	4	4	0	2	3	0	13
Unknown	1	0	0	0	0	1	2

NOTE.—From 1980 through 1985, 63 of 123 accidents occurred in the morning. In 2 cases, times were not listed and are shown as unknown.

Table 18.—Total days lost per year as a result of nonfatal electrical accidents at the surface at underground coal mines

Year	Accidents	Days lost
1980	31	429
1981	27	366
1982	20	233
1983	13	185
1984	18	553
1985	16	339
Total	125	2,105

ELECTRICAL ACCIDENTS IN UNDERGROUND METAL-NONMETAL MINES

Figure 3 is a graphical presentation of electrical fatal and nonfatal accidents in underground metal-nonmetal mines.

FATALITIES

Of 110 fatalities that occurred in underground metal-nonmetal mines from 1980 through 1985, 2% were electrical in nature (table 19). One fatality occurred while an electrician was performing electrical repair and maintenance on electrical apparatus; the other victim was a miner engaging in the welding and cutting of electrical apparatus. Both victims suffered electrocution. Both individuals had less than 5 years of experience at the specific job they were performing when the fatality occurred and both accidents occurred in the morning. One victim had been employed in that specific capacity for only 24 weeks. The other individual had 2 years 24 weeks of experience in that capacity. The average age of the victims was 29. Table 20 summarizes the pertinent information in this category.

NONFATAL ACCIDENTS

Of the 14,959 nonfatal accidents that occurred in underground metal-nonmetal mines, less than 1% were electrical in nature as identified in table 21. Electrical repair and maintenance was the activity most commonly engaged in when the nonfatal incident occurred (39 of 91 cases).

In 38 of 91 cases, the source of injury was electrical apparatus and in 26 of 91 cases, conductors, cables, and trolley poles were the source of the injury. Electricians incurred the greatest number of injuries (20 of 91 cases). Twenty-nine nonfatal electrical shocks occurred during this time period and 28 electrical arc burns. Again, as in all previous categories, the part of the body most frequently injured in nonfatal accidents was the hand. Also, as in all previous categories, the majority of the employees injured had less than 5 years experience at the specific job they were performing when the injury occurred (64% or 58 of 91 cases). The average age of the victims was 35.

Tables 22 through 25 summarize the pertinent information relative to nonfatal electrical accidents in underground metal-nonmetal mines.

**Table 19.—Electrical fatalities versus total fatalities
In underground metal-nonmetal mines**

Year	Electrical fatalities	Total fatalities
1980	0	20
1981	1	29
1982	0	23
1983	1	11
1984	0	14
1985	0	13
Total	2	110

Table 20.—Summary of fatal electrical accidents in underground metal-nonmetal mines

	1980	1981	1982	1983	1984	1985	Total
Activity when accident occurred:							
Weld, cut	0	1	0	0	0	0	1
Maintain, repair electrical equipment	0	0	0	1	0	0	1
Source of injury: Electrical apparatus	0	1	0	1	0	0	2
Job title:							
Miner	0	1	0	0	0	0	1
Electrician	0	0	0	1	0	0	1
Mining method:							
Other	0	1	0	0	0	0	1
Conventional, stope	0	0	0	1	0	0	1
Location: Other underground	0	1	0	1	0	0	2
Machine:							
Welder	0	1	0	0	0	0	1
Unknown	0	0	0	1	0	0	1
Nature of injury: Electric shock, electrocution	0	1	0	1	0	0	2
Accident type: Electric current	0	1	0	1	0	0	2
Part of body: Body systems	0	1	0	1	0	0	2

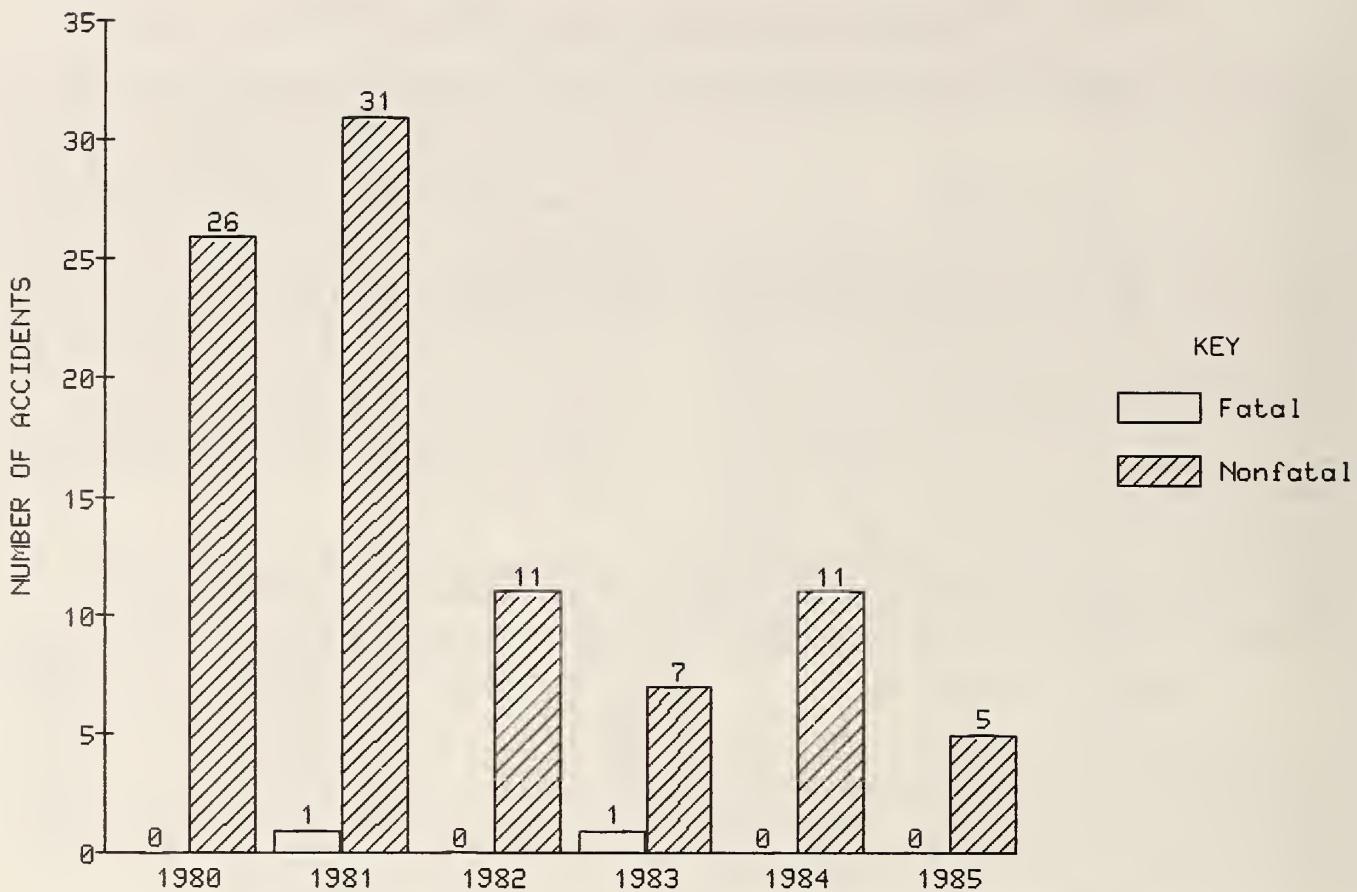


Figure 3.-Fatal and nonfatal electrical accidents in underground metal-nonmetal mines, 1980-85.

Table 21.-Electrical nonfatal accidents versus total nonfatal accidents
in underground metal-nonmetal mines

Year	Electrical nonfatal accidents	Total nonfatal accidents
1980	26	4,525
1981	31	4,138
1982	11	2,207
1983	7	1,522
1984	11	1,356
1985	5	1,211
Total	91	14,959

Table 22.—Summary of nonfatal electrical accidents in underground metal-nonmetal mines

	1980	1981	1982	1983	1984	1985	Total
Activity when accident occurred:							
Maintain, repair electrical equipment	10	12	5	3	6	3	39
Handle supplies, material	2	2	2	1	0	0	7
Maintain machine	3	2	0	1	0	0	6
Rerail equipment	1	2	0	0	1	0	4
Welding, cutting	1	0	1	2	0	0	4
Caging	2	1	0	0	0	0	3
Operate locomotive	2	1	0	0	0	0	3
Idle	0	1	0	0	0	1	2
Drill face, rib, side	0	1	0	0	1	0	2
Escaping a hazard	0	2	0	0	0	0	2
Operate slusher	1	1	0	0	0	0	2
Get on-off equipment	0	1	1	0	0	0	2
Use handtools	0	0	1	0	0	0	1
Use bull dozer	0	0	1	0	0	0	1
Walk, run	0	0	0	0	0	1	1
Use continuous miner	0	0	0	0	1	0	1
Operate-ride mantrip	0	0	0	0	1	0	1
Use powered handtools	0	0	0	0	1	0	1
Bolt roof	0	1	0	0	0	0	1
Bolt roof, insert bolt	0	1	0	0	0	0	1
Couple mine cars	0	1	0	0	0	0	1
Operate underground equipment	0	1	0	0	0	0	1
Move power cable	0	1	0	0	0	0	1
Climb raise, shaft	1	0	0	0	0	0	1
Use blow gun	1	0	0	0	0	0	1
Observe operations	1	0	0	0	0	0	1
Use cutting machine	1	0	0	0	0	0	1
Source of injury:							
Electrical apparatus	11	17	3	3	4	0	38
Conductors, cables, trolley poles	7	8	5	0	5	1	26
Underground mining machines	0	1	1	0	0	1	3
Machines, office machines	0	0	1	2	0	0	3
Flame, fire, smoke	1	1	0	0	0	1	3
Elevators, cages, skips	2	0	0	0	0	0	2
Acids, alkalies (wet cement)	1	1	0	0	0	0	2
Surface mining machines	0	0	1	0	0	0	1
Vehicles	0	0	0	1	0	0	1
Passenger cars, trucks	0	0	0	1	0	0	1
Transformers, converters	0	0	0	0	0	1	1
Metal (pipe, wire, nails, etc.)	0	0	0	0	0	1	1
Powered handtools	0	0	0	0	1	0	1
Drill, percussive	0	0	0	0	1	0	1
Molten metal	0	1	0	0	0	0	1
Floor, bottom	0	1	0	0	0	0	1
Coal and petroleum products	1	0	0	0	0	0	1
Apparel	1	0	0	0	0	0	1
Broken rock, coal waste	0	1	0	0	0	0	1
Welder	2	0	0	0	0	0	2
Miscellaneous	1	0	0	0	0	0	1
Job title:							
Electrician	6	4	4	1	3	2	20
Mechanic	2	4	0	2	1	0	9
Miner	3	3	2	0	0	0	8
Motorman	1	5	0	0	1	0	7
Laborer, muck machine operator	2	2	1	0	1	0	6
Labor foreman	1	1	0	2	0	0	4
Blaster	1	0	1	0	0	1	3
Utility man	0	1	0	0	1	1	3
Trainee	1	2	0	0	0	0	3
Unknown	1	1	0	0	0	1	3
Mine foreman	1	2	0	0	0	0	3
Mechanic, repairman	1	0	1	0	0	0	2
Master electrician	1	0	0	0	1	0	2
Continuous miner	0	1	0	0	1	0	2
Jackster	0	2	0	0	0	0	2
Maintenance foreman	1	0	0	0	0	0	1
Grizzly man	0	0	1	0	0	0	1
Welder, cement man	0	0	1	0	0	0	1
Master mechanic	0	0	0	1	0	0	1
Shuttle car operator	0	0	0	1	0	0	1
Beltman	0	0	0	0	1	0	1

Table 22.—Summary of nonfatal electrical accidents in underground metal-nonmetal mines—Continued

	1980	1981	1982	1983	1984	1985	Total
Job title—Continued							
Mucking machine	0	0	0	0	1	0	1
Pumper	1	0	0	0	0	0	1
Barge attendant	1	0	0	0	0	0	1
Oiler, greaseman	1	0	0	0	0	0	1
Cutting machine operator	1	0	0	0	0	0	1
Drift miner	0	1	0	0	0	0	1
Wireman	0	1	0	0	0	0	1
Loading machine operator	0	1	0	0	0	0	1
Machine:							
Unknown	0	0	5	1	3	2	11
Machine, not elsewhere classified	0	0	0	3	1	0	4
Welder	0	0	1	2	0	0	3
Pump	0	1	0	0	0	1	2
Rock drill, jackleg, jackhammer, drifter, etc	0	0	0	0	1	1	2
Nonpowered handtools	0	0	2	0	0	0	2
Roof bolter	0	0	0	0	0	1	1
Man trip, man car, jeep, personnel carrier, etc	0	0	0	0	1	0	1
Powered handtools	0	0	0	0	1	0	1
Hydraulic, electric core drills	0	0	0	0	1	0	1
Load-haul-dump, scoop tram, ram car, etc	0	0	0	0	1	0	1
Continuous miner, tunnel borer	0	0	0	0	1	0	1
Locomotive, rail-mounted; lorry car	0	0	0	0	1	0	1
Service truck, pickup, utility truck (not ore haulage)	0	0	0	1	0	0	1
Dozer, crawler tractor	0	0	1	0	0	0	1
Pneumatic-blasting agent loader	0	0	1	0	0	0	1
Ore-haulage truck, off-highway or underground	0	1	0	0	0	0	1
Cutting machine (mining only), chain cutter	2	1	0	0	0	0	3
Skip, elevator, cage	2	1	0	0	0	0	3
Shuttle car	0	1	0	0	0	0	1
Conveyor, all types; belt feeder	0	1	0	0	0	0	1
Loading machine, gathering-arm, etc	0	1	0	0	0	0	1
Slusher, scraper hoist, scram, etc	2	2	0	0	0	0	4
Jumbo carriage-mounted drills on rails tracks, tires	0	1	0	0	0	0	1
Fan	2	1	0	0	0	0	3
Sizing machine	1	0	0	0	0	0	1
Nature of injury:							
Electrical shock (electrocution)	4	12	5	4	3	1	29
Electrical arc burn	8	8	4	2	6	0	28
Electrical burn (contact burn)	5	6	2	1	1	2	17
Asphyxia	3	1	0	0	0	0	4
Burn or scald (heat)	2	0	0	0	0	1	3
Chemical burn	1	1	0	0	1	0	3
Multiple injuries	0	1	0	0	0	0	1
Laceration, cut, puncture	0	1	0	0	0	0	1
Sprain, strain	1	0	0	0	0	0	1
Bruise	0	1	0	0	0	0	1
Scratches, abrasions	1	0	0	0	0	0	1
Fracture	1	0	0	0	0	0	1
Other, not elsewhere classified	0	0	0	0	0	1	1
Part of body:							
Body systems	7	13	5	4	3	1	33
Hand	3	4	2	1	1	1	12
Eyes	5	3	1	1	2	0	12
Multiple injuries	1	2	1	1	4	1	10
Upper extremities, multiple	2	3	2	0	1	1	9
Ankle	2	1	0	0	0	0	3
Fingers	1	1	0	0	0	0	2
Arm	1	1	0	0	0	0	2
Wrist	2	0	0	0	0	0	2
Forearm	1	1	0	0	0	0	2
Foot	1	0	0	0	0	0	1
Body parts, not elsewhere classified	0	0	0	0	0	1	1
Shoulders	0	1	0	0	0	0	1
Knee	0	1	0	0	0	0	1

Table 23.-Years of experience¹ at specific job when nonfatal electrical accident occurred in underground metal-nonmetal mines

Year	0-5	6-10	11-15	16-20	Over 20	Unknown
1980	18	4	0	0	2	2
1981	19	7	1	0	2	2
1982	10	0	0	0	0	1
1983	6	0	0	1	0	0
1984	5	3	1	0	0	2
1985	0	3	0	0	0	2
Total	58	17	2	1	4	9

¹Data do not represent total mining experience of employees, only experience at the specific job being performed when accident occurred.

Table 24.-Times when electrical nonfatal accidents occurred in underground metal-nonmetal mines

	1980	1981	1982	1983	1984	1985	Total
11:01 a.m. to 1:01 p.m.	1	3	4	1	2	3	14
1:01 to 3:01 p.m.	2	5	0	1	0	0	8
3:01 to 5:01 p.m.	3	1	0	2	1	0	7
5:01 to 7:01 p.m.	1	2	0	1	3	0	7
7:01 to 9:01 p.m.	1	2	0	0	1	0	4
9:01 to 11:01 p.m.	1	0	0	0	0	0	1
11:01 p.m. to 1:01 a.m.	1	0	0	0	0	0	1
1:01 to 3:01 a.m.	2	3	2	0	0	0	7
3:01 to 5:01 a.m.	1	0	1	1	1	0	4
5:01 to 7:01 a.m.	0	1	0	0	0	1	2
7:01 to 9:01 a.m.	3	6	0	1	3	0	13
9:01 to 11:01 a.m.	8	7	3	0	0	0	18
Unknown	2	1	1	0	0	1	5

NOTE.—From 1980 through 1985, 55 of 86 accidents occurred in the morning. In 5 cases times were not listed and are shown as unknown.

Table 25.-Total days lost per year as a result of nonfatal electrical accidents in underground metal-nonmetal mines

Year	Accidents	Days lost
1980	26	215
1981	31	520
1982	11	267
1983	7	39
1984	11	71
1985	5	237
Total	91	1,349

ELECTRICAL ACCIDENTS AT THE SURFACE AT UNDERGROUND METAL-NONMETAL MINES

Figure 4 is a graphical presentation of electrical accidents in underground metal-nonmetal mines at the surface, including associated shops, yards, and tipple when located at the mine.

FATALITIES

Of 17 fatalities that occurred in surface at underground metal-nonmetal mines, four were electrical in nature as identified (table 26). Each accident occurred while the victim was performing electrical maintenance and repair. All victims suffered electrocution. Three of the four individuals had less than 5 years of experience at the specific job they were performing when the accident occurred. The average age of the victims was 39. Tables 27 through 29 summarize the pertinent information in this category.

NONFATAL ACCIDENTS

Of the 2,281 nonfatal accidents that occurred at the surface at underground metal-nonmetal mines, 34 or 1.5% were electrical in nature (table 30). Electrical repair and maintenance was the activity most commonly engaged in when the nonfatal incident occurred (19 of 34 cases).

Electrical apparatus was the most common source of injury (20 of 34 cases) and electrical arc burns were the predominant injury. This is the first category in which multiple injuries outnumbered hand injuries as the part of the body most commonly injured. In 59% of these accidents, the employees had less than 5 years of experience at the specific job they were performing when the accident occurred (20 of 34 cases). The average age of the victims was 39.

Tables 31 through 34 summarize the pertinent information relative to nonfatal electrical accidents at the surface of underground metal-nonmetal mines.

Table 26.—Electrical fatalities versus total fatalities at the surface at underground metal-nonmetal mines

Year	Electrical fatalities	Total fatalities
1980	0	3
1981	0	2
1982	1	3
1983	1	1
1984	1	5
1985	1	3
Total	4	17

Table 27.—Summary of fatal electrical accidents at the surface at underground metal-nonmetal mines

	1980	1981	1982	1983	1984	1985	Total
Activity when accident occurred:							
Maintain, repair electrical equipment	0	0	1	1	1	1	4
Source of injury:							
Electrical apparatus	0	0	1	1	0	0	2
Generators	0	0	0	0	0	1	1
Conductors, cables, trolley poles	0	0	0	0	1	0	1
Job title:							
Electrician	0	0	1	1	1	0	3
Watchman	0	0	0	0	0	1	1
Machine:							
Not recorded in MSHA data base	0	0	1	0	1	1	3
Skip, elevator, cage	0	0	0	1	0	0	1
Nature of injury: Electric shock, electrocution	0	0	1	1	1	1	4
Accident type: Electric current	0	0	1	1	1	1	4
Part of body: Body systems	0	0	1	1	1	1	4

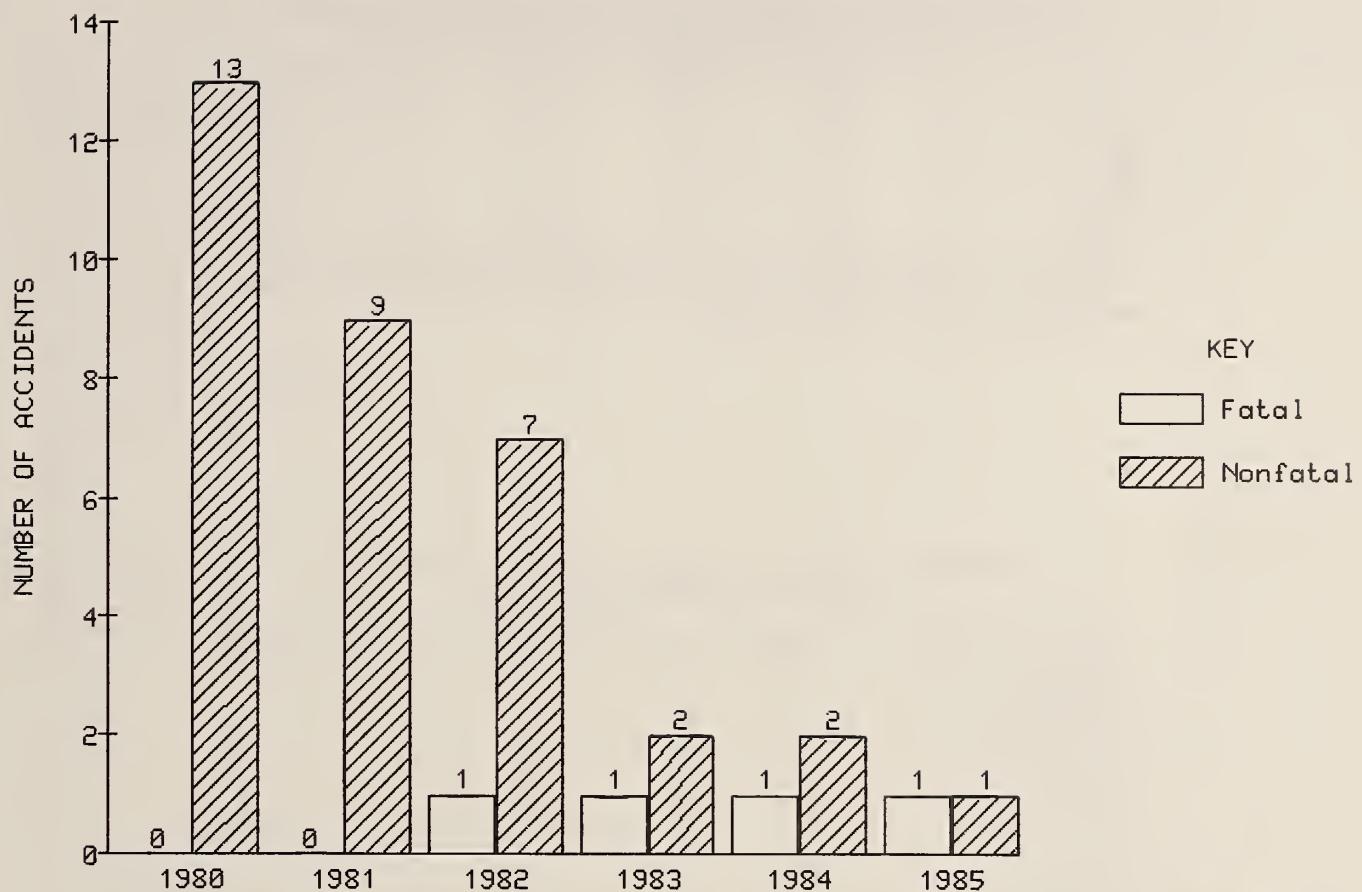


Figure 4.-Fatal and nonfatal electrical accidents at the surface at underground metal-nonmetal mines, 1980-85.

Table 28.-Years of job experience¹ at specific job when fatal electrical accident occurred at the surface at underground metal-nonmetal mines

Years	0-5	6-10	11-15	16-20	Over 20
1980	0	0	0	0	0
1981	0	0	0	0	0
1982	1	0	0	0	0
1983	1	0	0	0	0
1984	1	0	0	0	0
1985	0	1	0	0	0
Total	3	1	0	0	0

¹Data do not represent total mining experience of employees, only experience at the specific job being performed when accident occurred.

Table 29.-Times when electrical fatal accidents occurred at the surface at underground metal-nonmetal mines

	1980	1981	1982	1983	1984	1985	Total
11:01 a.m. to 1:01 p.m.	0	0	0	0	0	0	0
1:01 to 3:01 p.m.	0	0	1	0	0	0	1
3:01 to 5:01 p.m.	0	0	0	0	0	1	1
5:01 to 7:01 p.m.	0	0	0	0	0	0	0
7:01 to 9:01 p.m.	0	0	0	0	0	0	0
9:01 to 11:01 p.m.	0	0	0	0	0	0	0
11:01 p.m. to 1:01 a.m.	0	0	0	0	0	0	0
1:01 to 3:01 a.m.	0	0	0	0	0	0	0
3:01 to 5:01 a.m.	0	0	0	0	0	0	0
5:01 to 7:01 a.m.	0	0	0	0	0	0	0
7:01 to 9:01 a.m.	0	0	0	0	0	0	0
9:01 to 11:01 a.m.	0	0	0	1	1	0	2

NOTE.—From 1980 through 1985, 2 accidents occurred in the morning and 2 accidents occurred in the afternoon.

Table 30.-Electrical nonfatal accidents versus total nonfatal accidents at the surface at underground metal-nonmetal mines

Year	Electrical nonfatal accidents	Total nonfatal accidents
1980	13	651
1981	9	711
1982	7	322
1983	2	191
1984	2	215
1985	1	191
Total	34	2,281

Table 31.—Summary of nonfatal electrical accidents at the surface at underground metal-nonmetal mines

	1980	1981	1982	1983	1984	1985	Total
Activity when accident occurred:							
Maintain, repair electrical equipment	9	4	3	2	0	1	19
Handle supplies, material	0	1	4	0	1	0	6
Maintain machine	1	1	0	0	0	0	2
Caging	1	0	0	0	1	0	2
Install and maintain ventilation	0	1	0	0	0	0	1
Use powered handtools	0	1	0	0	0	0	1
Idle	0	1	0	0	0	0	1
Move equipment	1	0	0	0	0	0	1
Operate surface equipment	1	0	0	0	0	0	1
Source of injury:							
Electrical apparatus	9	5	2	2	1	1	20
Acids, alkalies (wet cement)	1	2	4	0	0	0	7
Conductors, cables, trolley poles	2	1	0	0	1	0	4
Drill, rotary	0	1	0	0	0	0	1
Movable ladders	0	0	1	0	0	0	1
Surface mining machines	1	0	0	0	0	0	1
Job title:							
Electrician	5	0	3	2	0	1	11
Mechanic	2	3	2	0	1	0	8
Tipple operator	1	1	0	0	0	0	2
Stopping builder	0	2	0	0	0	0	2
Electrical helper	1	1	0	0	0	0	2
Maintenance foreman	1	1	0	0	0	0	2
Mine foreman	1	0	0	0	0	0	1
Drill operator	1	0	0	0	0	0	1
Truck driver	0	1	0	0	0	0	1
Laborer	0	0	1	0	0	0	1
Boney operator	0	0	1	0	0	0	1
Hoistman	0	0	0	0	1	0	1
Carpenter	1	0	0	0	0	0	1
Machine:							
Not recorded in MSHA data base	6	3	6	1	0	1	17
Skip, elevator, cage	1	0	0	1	1	0	3
Service truck, pickup, utility truck (not ore haulage)	1	0	1	0	0	0	2
Nonpowered handtools	0	2	0	0	0	0	2
Crane, derrick	0	1	0	0	1	0	2
Machine, not elsewhere classified	1	0	0	0	0	0	1
Pump	1	0	0	0	0	0	1
Jumbo carriage-mounted drills on rails, tracks, tires	1	0	0	0	0	0	1
Compressor	1	0	0	0	0	0	1
Pneumatic blasting agent loader	1	0	0	0	0	0	1
Fan	0	1	0	0	0	0	1
Powered handtools	0	1	0	0	0	0	1
Load-haul-dump, scoop tram, ram car, etc	0	1	0	0	0	0	1
Nature of injury:							
Electrical arc burn	7	3	1	2	1	1	15
Chemical burns	1	2	4	0	0	0	7
Electrical shock (electrocution)	3	3	1	0	0	0	7
Electrical burn (contact burn)	2	1	1	0	0	0	4
Amputation	0	0	0	0	1	0	1
Accident type:							
Flash burns, electric	7	3	1	2	1	1	15
Electric shock	5	4	2	0	1	0	12
Absorption of toxics	1	2	4	0	0	0	7
Part of body:							
Multiple injuries	3	1	2	1	0	1	8
Eyes	3	2	2	0	0	0	7
Body systems	3	3	1	0	0	0	7
Hand	2	0	0	1	1	0	4
Face	0	1	1	0	0	0	2
Upper extremities, multiple	1	1	0	0	0	0	2
Fingers	0	0	0	0	1	0	1
Neck	1	0	0	0	0	0	1
Face, multiple parts	0	0	1	0	0	0	1
Chest	0	1	0	0	0	0	1

Table 32.-Years of experience¹ at specific job when nonfatal accident occurred at the surface at underground metal-nonmetal mines

Year	0-5	6-10	11-15	16-20	Over 20	Unknown
1980	6	2	0	0	2	3
1981	7	0	1	1	0	0
1982	6	0	1	0	0	0
1983	1	1	0	0	0	0
1984	0	1	0	0	0	1
1985	0	0	1	0	0	0
Total	20	4	3	1	2	4

¹Data do not represent total mining experience of employees, only experience at the specific job being performed when accident occurred.

Table 33.-Times when electrical nonfatal accidents occurred at the surface at underground metal-nonmetal mines

	1980	1981	1982	1983	1984	1985	Total
11:01 a.m. to 1:01 p.m.	5	1	1	0	0	1	8
1:01 to 3:01 p.m.	2	1	0	0	1	0	4
3:01 to 5:01 p.m.	2	1	1	0	0	0	4
5:01 to 7:01 p.m.	0	2	0	0	0	0	2
7:01 to 9:01 p.m.	1	0	1	0	0	0	2
9:01 to 11:01 p.m.	0	0	0	0	0	0	0
11:01 p.m. to 1:01 a.m.	0	1	0	0	1	0	2
1:01 to 3:01 a.m.	0	0	0	0	0	0	0
3:01 to 5:01 a.m.	0	0	0	0	0	0	0
5:01 to 7:01 a.m.	0	0	0	0	0	0	0
7:01 to 9:01 a.m.	0	0	3	1	0	0	4
9:01 to 11:01 a.m.	2	3	1	1	0	0	7
Unknown	1	0	0	0	0	0	1

NOTE.—From 1980 through 1985, 18 of 33 accidents occurred in the morning. In 1 case, the time was not listed and is shown as unknown.

Table 34.-Total days lost per year as a result of nonfatal electrical accidents at the surface at underground metal-nonmetal mines

Year	Accidents	Days lost
1980	13	562
1981	9	359
1982	7	224
1983	2	112
1984	2	175
1985	1	3
Total	34	1,435

COST INFORMATION

This section provides estimates of the costs of work-related injuries for 1980 through 1985 for the following four mining sectors:

Underground coal mines
 Surface at underground coal mines
 Underground metal-nonmetal mines

Surface at underground metal-nonmetal mines

The cost information for each year for these mining sectors, including the costs of all fatalities, the costs of all nonfatal accidents, and the combined costs of fatal and nonfatal accidents are given in tables 35 through 58.

Table 35.—Cost Information relative to electrical accidents in underground coal mines, 1980

Cost to—	Element sum	% of total
FATALITIES (10)		
Industry:		
State Worker Compensation benefits	\$990,526	13.8
Postaccident production loss	794,181	11.1
Primary medical treatment	0	.0
Union death or disability benefits	269,174	3.8
Fatal accident investigation	10,844	.2
Total	2,064,725	28.8
Family: Loss of wages	2,632,499	36.8
Public sector:		
Federal Social Security benefits	2,423,543	33.8
Fatal accident investigation	40,586	.6
Total	2,464,129	34.4
Grand total	7,161,353	100.0
NONFATAL ACCIDENTS (303)		
Industry:		
State Worker Compensation benefits	\$203,521	36.5
Postaccident production loss	0	.0
Primary medical treatment	209,813	37.6
Union death or disability benefits	8,520	1.5
Fatal accident investigation	0	.0
Total	421,854	75.7
Family: Loss of wages	129,560	23.2
Public sector:		
Federal Social Security benefits	6,021	1.1
Fatal accident investigation	0	.0
Total	6,021	1.1
Grand total	557,435	100.0
COMBINED FATAL AND NONFATAL ACCIDENTS (313)		
Industry:		
State Worker Compensation benefits	\$1,194,047	13.8
Postaccident production loss	794,181	10.3
Primary medical treatment	209,813	2.7
Union death or disability benefits	277,694	3.6
Fatal accident investigation	10,844	.1
Total	2,486,579	32.2
Family: Loss of wages	2,762,059	35.8
Public sector:		
Federal Social Security benefits	2,429,564	31.5
Fatal accident investigation	40,586	.5
Total	2,470,150	32.0
Grand total	7,718,788	100.0

Table 36.—Cost information relative to electrical accidents in underground coal mines, 1981

Cost to-	Element sum	% of total
FATALITIES (8)		
Industry:		
State Worker Compensation benefits	\$559,914	6.7
Postaccident production loss	2,469,647	29.3
Primary medical treatment	0	.0
Union death or disability benefits	430,000	5.1
Fatal accident investigation	10,901	.1
Total	3,470,462	41.2
Family: Loss of wages	3,146,706	37.4
Public sector:		
Federal Social Security benefits	1,759,078	20.9
Fatal accident investigation	41,058	.5
Total	1,800,136	21.4
Grand total	8,417,304	100.0
NONFATAL ACCIDENTS (243)		
Industry:		
State Worker Compensation benefits	\$158,692	32.0
Postaccident production loss	0	.0
Primary medical treatment	178,795	36.1
Union death or disability benefits	8,581	1.8
Fatal accident investigation	0	.0
Total	346,068	69.9
Family: Loss of wages	149,280	30.1
Public sector:		
Federal Social Security benefits	0	.0
Fatal accident investigation	0	.0
Total	0	.0
Grand total	557,435	100.0
COMBINED FATAL AND NONFATAL ACCIDENTS (251)		
Industry:		
State Worker Compensation benefits	\$718,606	8.1
Postaccident production loss	2,469,647	27.7
Primary medical treatment	178,795	2.0
Union death or disability benefits	438,581	4.9
Fatal accident investigation	10,901	.1
Total	3,816,530	42.8
Family: Loss of wages	3,195,986	37.0
Public sector:		
Federal Social Security benefits	1,759,078	19.7
Fatal accident investigation	41,058	.5
Total	1,800,136	20.2
Grand total	8,912,652	100.0

Table 37.—Cost information relative to electrical accidents in underground coal mines, 1982

Cost to—	Element sum	% of total
FATALITIES (4)		
Industry:		
State Worker Compensation benefits	\$488,951	13.2
Postaccident production loss	1,033,751	28.1
Primary medical treatment	0	.0
Union death or disability benefits	230,133	6.2
Fatal accident investigation	5,779	.2
Total	1,758,614	47.7
Family: Loss of wages	1,361,826	37.0
Public sector:		
Federal Social Security benefits	545,572	14.8
Fatal accident investigation	19,256	.5
Total	564,828	15.3
Grand total	3,685,268	100.0
NONFATAL ACCIDENTS (240)		
Industry:		
State Worker Compensation benefits	\$199,713	38.1
Postaccident production loss	0	.0
Primary medical treatment	142,311	27.1
Union death or disability benefits	8,123	1.5
Fatal accident investigation	0	.0
Total	350,147	66.8
Family: Loss of wages	162,120	30.9
Public sector:		
Federal Social Security benefits	12,266	2.3
Fatal accident investigation	0	.0
Total	12,266	2.3
Grand total	524,533	100.0
COMBINED FATAL AND NONFATAL ACCIDENTS (244)		
Industry:		
State Worker Compensation benefits	\$688,664	16.4
Postaccident production loss	1,033,751	24.6
Primary medical treatment	142,311	3.4
Union death or disability benefits	238,256	5.7
Fatal accident investigation	5,779	.1
Total	2,108,761	50.1
Family: Loss of wages	1,523,946	36.2
Public sector:		
Federal Social Security benefits	557,838	13.3
Fatal accident investigation	19,256	.5
Total	577,094	13.7
Grand total	4,209,801	100.0

Table 38.—Cost information relative to electrical accidents in underground coal mines, 1983

Cost to—	Element sum	% of total
FATALITIES (4)		
Industry:		
State Worker Compensation benefits	\$584,562	9.0
Postaccident production loss	2,823,489	43.9
Primary medical treatment	0	0
Union death or disability benefits	215,000	3.3
Fatal accident investigation	5,700	.1
Total	3,628,751	56.3
Family: Loss of wages	1,052,688	16.4
Public sector:		
Federal Social Security benefits	1,735,376	27.0
Fatal accident investigation	20,585	.3
Total	1,755,961	27.3
Grand total	6,437,400	100.0
NONFATAL ACCIDENTS (120)		
Industry:		
State Worker Compensation benefits	\$132,415	36.5
Postaccident production loss	0	.0
Primary medical treatment	104,730	28.9
Union death or disability benefits	3,373	.9
Fatal accident investigation	0	.0
Total	240,518	66.3
Family: Loss of wages	99,911	27.6
Public sector:		
Federal Social Security benefits	22,162	6.1
Fatal accident investigation	0	.0
Total	22,162	6.1
Grand total	362,591	100.0
COMBINED FATAL AND NONFATAL ACCIDENTS (124)		
Industry:		
State Worker Compensation benefits	\$716,977	56.9
Postaccident production loss	2,823,489	41.5
Primary medical treatment	104,730	1.5
Union death or disability benefits	218,373	3.2
Fatal accident investigation	5,700	.1
Total	3,869,269	56.9
Family: Loss of wages	1,152,599	17.0
Public sector:		
Federal Social Security benefits	1,757,538	25.8
Fatal accident investigation	20,585	.3
Total	1,778,123	26.1
Grand total	6,799,991	100.0

Table 39.—Cost information relative to electrical accidents in underground coal mines, 1984

Cost to—	Element sum	% of total
FATALITIES (3)		
Industry:		
State Worker Compensation benefits	\$346,684	9.3
Postaccident production loss	696,053	18.7
Primary medical treatment	0	.0
Union death or disability benefits	161,250	4.3
Fatal accident investigation	4,188	.1
Total	1,208,175	32.4
Family: Loss of wages	1,161,305	31.2
Public sector:		
Federal Social Security benefits	1,340,422	36.0
Fatal accident investigation	13,990	.4
Total	1,354,412	36.4
Grand total	3,723,892	100.0
NONFATAL ACCIDENTS (122)		
Industry:		
State Worker Compensation benefits	\$302,269	49.1
Postaccident production loss	0	.0
Primary medical treatment	77,907	12.6
Union death or disability benefits	2,441	.4
Fatal accident investigation	0	.0
Total	382,617	62.1
Family: Loss of wages	197,953	32.1
Public sector:		
Federal Social Security benefits	36,061	5.8
Fatal accident investigation	0	.0
Total	36,061	5.8
Grand total	616,631	100.0
COMBINED FATAL AND NONFATAL ACCIDENTS (125)		
Industry:		
State Worker Compensation benefits	\$648,953	15.0
Postaccident production loss	696,053	16.0
Primary medical treatment	77,907	1.8
Union death or disability benefits	163,691	3.8
Fatal accident investigation	4,188	.1
Total	1,590,792	36.6
Family: Loss of wages	1,359,258	31.3
Public sector:		
Federal Social Security benefits	1,376,483	31.7
Fatal accident investigation	13,990	.3
Total	1,390,473	32.0
Grand total	4,340,523	100.0

Table 40.—Cost information relative to electrical accidents in underground coal mines, 1985

Cost to—	Element sum	% of total
FATALITIES (3)		
Industry:		
State Worker Compensation benefits	\$412,273	14.2
Postaccident production loss	400,683	13.7
Primary medical treatment	0	.0
Union death or disability benefits	193,500	6.6
Fatal accident investigation	5,154	.2
Total	1,011,610	34.7
Family: Loss of wages	1,122,732	38.4
Public sector:		
Federal Social Security benefits	766,558	26.3
Fatal accident investigation	19,287	.7
Total	785,845	26.9
Grand total	2,920,187	100.0
NONFATAL ACCIDENTS (118)		
Industry:		
State Worker Compensation benefits	\$127,450	39.4
Postaccident production loss	0	.0
Primary medical treatment	90,476	28.0
Union death or disability benefits	4,198	1.3
Fatal accident investigation	0	.0
Total	222,124	68.6
Family: Loss of wages	91,066	28.1
Public sector:		
Federal Social Security benefits	10,452	3.2
Fatal accident investigation	0	.0
Total	10,452	3.2
Grand total	323,642	100.0
COMBINED FATAL AND NONFATAL ACCIDENTS (121)		
Industry:		
State Worker Compensation benefits	\$539,723	16.6
Postaccident production loss	400,683	12.4
Primary medical treatment	90,476	2.8
Union death or disability benefits	197,698	6.1
Fatal accident investigation	5,154	.2
Total	1,233,734	38.0
Family: Loss of wages	1,213,798	37.4
Public sector:		
Federal Social Security benefits	777,010	24.0
Fatal accident investigation	19,287	.6
Total	796,297	24.5
Grand total	3,243,829	100.0

Table 41.—Cost Information relative to electrical accidents¹ at the surface at underground coal mines, 1980

Cost to—	Element sum	% of total
Industry:		
State Worker Compensation benefits	\$19,196	30.6
Postaccident production loss	0	.0
Primary medical treatment	20,873	33.3
Union death or disability benefits	721	1.1
Fatal accident investigation	0	.0
Total	40,790	65.0
Family: Loss of wages	21,929	35.0
Public sector:		
Federal Social Security benefits	0	.0
Fatal accident investigation	0	.0
Total	0	.0
Grand total	62,719	100.0

¹31 nonfatal accidents; no fatal accidents.

Table 42.—Cost information relative to electrical accidents at the surface at underground coal mines, 1981

Cost to—	Element sum	% of total
FATALITIES (1)		
Industry:		
State Worker Compensation benefits	\$149,088	20.3
Postaccident production loss	0	.0
Primary medical treatment	0	.0
Union death or disability benefits	53,750	7.3
Fatal accident investigation	2,101	.3
Total	204,939	27.9
Family: Loss of wages	161,495	22.0
Public sector:		
Federal Social Security benefits	363,297	49.4
Fatal accident investigation	5,153	.7
Total	368,450	50.1
Grand total	734,884	100.0
NONFATAL ACCIDENTS (27)		
Industry:		
State Worker Compensation benefits	19,197	62.0
Postaccident production loss	0	.0
Primary medical treatment	9,056	19.5
Union death or disability benefits	584	1.3
Fatal accident investigation	0	.0
Total	28,837	62.0
Family: Loss of wages	17,674	38.0
Public sector:		
Federal Social Security benefits	0	.0
Fatal accident investigation	0	.0
Total	0	.0
Grand total	46,511	100.0
COMBINED FATAL AND NONFATAL ACCIDENTS (28)		
Industry:		
State Worker Compensation benefits	168,285	21.5
Postaccident production loss	0	.0
Primary medical treatment	9,056	1.2
Union death or disability benefits	54,344	7.0
Fatal accident investigation	2,101	.3
Total	233,776	29.9
Family: Loss of wages	179,169	22.9
Public sector:		
Federal Social Security benefits	363,297	46.5
Fatal accident investigation	5,153	.7
Total	368,450	47.2
Grand total	781,395	100.0

Table 43.—Cost information relative to electrical accidents at the surface at underground coal mines, 1982

Cost to—	Element sum	% of total
	FATALITIES (2)	
Industry:		
State Worker Compensation benefits	\$265,295	21.0
Postaccident production loss	0	.0
Primary medical treatment	0	.0
Union death or disability benefits	107,500	8.5
Fatal accident investigation	3,598	.3
Total	376,393	29.8
Family: Loss of wages	256,591	20.3
Public sector:		
Federal Social Security benefits	620,009	49.1
Fatal accident investigation	10,936	.8
Total	630,945	49.9
Grand total	1,263,929	100.0
NONFATAL ACCIDENTS (20)		
Industry:		
State Worker Compensation benefits	12,013	39.2
Postaccident production loss	0	.0
Primary medical treatment	6,286	20.5
Union death or disability benefits	632	2.1
Fatal accident investigation	0	.0
Total	18,931	61.8
Family: Loss of wages	11,678	38.2
Public sector:		
Federal Social Security benefits	0	.0
Fatal accident investigation	0	.0
Total	0	.0
Grand total	30,609	100.0
COMBINED FATAL AND NONFATAL ACCIDENTS (22)		
Industry:		
State Worker Compensation benefits	277,308	21.4
Postaccident production loss	0	.0
Primary medical treatment	6,286	.5
Union death or disability benefits	108,132	8.4
Fatal accident investigation	3,598	.3
Total	395,324	30.6
Family: Loss of wages	268,269	20.7
Public sector:		
Federal Social Security benefits	620,009	47.9
Fatal accident investigation	10,936	.8
Total	630,945	48.7
Grand total	1,294,538	100.0

Table 44.—Cost Information relative to electrical accidents at the surface at underground coal mines, 1983

Cost to-	Element sum	% of total
FATALITIES (2)		
Industry:		
State Worker Compensation benefits	\$236,712	14.9
Postaccident production loss	0	.0
Primary medical treatment	0	.0
Union death or disability benefits	107,500	6.8
Fatal accident investigation	2,439	.2
Total	346,651	21.8
Family: Loss of wages	1,016,102	64.0
Public sector:		
Federal Social Security benefits	217,679	13.7
Fatal accident investigation	8,083	.5
Total	225,762	14.2
Grand total	1,588,515	100.0
NONFATAL ACCIDENTS (13)		
Industry:		
State Worker Compensation benefits	10,283	45.3
Postaccident production loss	0	.0
Primary medical treatment	2,474	10.9
Union death or disability benefits	354	1.6
Fatal accident investigation	0	.0
Total	13,111	57.8
Family: Loss of wages	9,592	42.2
Public sector:		
Federal Social Security benefits	0	.0
Fatal accident investigation	0	.0
Total	0	.0
Grand total	22,703	100.0
COMBINED FATAL AND NONFATAL ACCIDENTS (15)		
Industry:		
State Worker Compensation benefits	246,995	15.3
Postaccident production loss	0	.0
Primary medical treatment	2,474	.2
Union death or disability benefits	107,854	6.7
Fatal accident investigation	2,439	.2
Total	359,762	22.3
Family: Loss of wages	1,025,694	63.7
Public sector:		
Federal Social Security benefits	217,679	13.5
Fatal accident investigation	8,083	.5
Total	225,762	14.0
Grand total	1,611,218	100.0

Table 45.—Cost information relative to electrical accidents at the surface at underground coal mines, 1984

Cost to—	Element sum	% of total
FATALITIES (1)		
Industry:		
State Worker Compensation benefits	\$151,342	19.1
Postaccident production loss	0	.0
Primary medical treatment	0	.0
Union death or disability benefits	53,750	6.8
Fatal accident investigation	2,158	.3
Total	207,250	26.1
Family: Loss of wages	384,618	48.4
Public sector:		
Federal Social Security benefits	194,568	24.5
Fatal accident investigation	7,750	1.0
Total	202,318	25.5
Grand total	794,186	100.0
NONFATAL ACCIDENTS (18)		
Industry:		
State Worker Compensation benefits	35,835	45.8
Postaccident production loss	0	.0
Primary medical treatment	9,768	12.5
Union death or disability benefits	921	1.2
Fatal accident investigation	0	.0
Total	46,524	59.4
Family: Loss of wages	19,602	25.0
Public sector:		
Federal Social Security benefits	12,187	15.6
Fatal accident investigation	0	.0
Total	12,187	15.6
Grand total	78,313	100.0
COMBINED FATAL AND NONFATAL ACCIDENTS (19)		
Industry:		
State Worker Compensation benefits	187,177	21.5
Postaccident production loss	0	.0
Primary medical treatment	9,768	1.1
Union death or disability benefits	54,671	6.3
Fatal accident investigation	2,158	.2
Total	253,774	29.1
Family: Loss of wages	404,220	46.3
Public sector:		
Federal Social Security benefits	206,755	23.7
Fatal accident investigation	7,750	.9
Total	214,505	24.6
Grand total	872,499	100.0

Table 46.—Cost information relative to electrical accidents at the surface at underground coal mines, 1985

Cost to—	Element sum	% of total
FATALITIES (2)		
Industry:		
State Worker Compensation benefits	\$255,289	14.5
Postaccident production loss	0	.0
Primary medical treatment	0	.0
Union death or disability benefits	129,000	7.3
Fatal accident investigation	2,906	.2
Total	387,195	22.0
Family: Loss of wages	1,219,632	69.2
Public sector:		
Federal Social Security benefits	143,343	8.2
Fatal accident investigation	11,178	.6
Total	154,521	8.8
Grand total	1,761,348	100.0
NONFATAL ACCIDENTS (16)		
Industry:		
State Worker Compensation benefits	100,649	53.9
Postaccident production loss	0	.0
Primary medical treatment	14,210	7.6
Union death or disability benefits	210	.1
Fatal accident investigation	0	.0
Total	115,069	61.6
Family: Loss of wages	71,662	38.4
Public sector:		
Federal Social Security benefits	0	.0
Fatal accident investigation	0	.0
Total	0	.0
Grand total	186,731	100.0
COMBINED FATAL AND NONFATAL ACCIDENTS (18)		
Industry:		
State Worker Compensation benefits	355,938	18.3
Postaccident production loss	0	.0
Primary medical treatment	14,210	.7
Union death or disability benefits	129,210	6.6
Fatal accident investigation	2,906	.1
Total	502,365	25.8
Family: Loss of wages	1,291,294	66.3
Public sector:		
Federal Social Security benefits	143,343	7.4
Fatal accident investigation	11,178	.6
Total	154,521	7.9
Grand total	1,948,079	100.0

Table 47.—Cost information relative to electrical accidents¹ in underground metal-nonmetal mines, 1980

Cost to—	Element sum	% of total
Industry:		
State Worker Compensation benefits	\$7,624	30.6
Postaccident production loss	0	.0
Primary medical treatment	31,851	61.6
Union death or disability benefits	632	1.2
Fatal accident investigation	0	.0
Total	40,107	77.6
Family: Loss of wages	11,586	22.4
Public sector:		
Federal Social Security benefits	0	.0
Fatal accident investigation	0	.0
Total	0	.0
Grand total	51,693	100.0

¹26 nonfatal accidents; no fatal accidents.

Table 48.—Cost information relative to electrical accidents in underground metal-nonmetal mines, 1981

Cost to—	Element sum	% of total
	FATALITIES (1)	
Industry:		
State Worker Compensation benefits	\$0	.0
Postaccident production loss	0	.0
Primary medical treatment	0	.0
Union death or disability benefits	53,750	7.2
Fatal accident investigation	1,881	.2
Total	55,631	7.4
Family: Loss of wages	690,152	91.8
Public sector:		
Federal Social Security benefits	0	.0
Fatal accident investigation	5,744	.8
Total	5,744	0.8
Grand total	751,527	100.0
	NONFATAL ACCIDENTS (31)	
Industry:		
State Worker Compensation benefits	23,359	57.5
Postaccident production loss	0	.0
Primary medical treatment	7,258	13.3
Union death or disability benefits	708	1.3
Fatal accident investigation	0	.0
Total	31,325	57.5
Family: Loss of wages	23,152	42.5
Public sector:		
Federal Social Security benefits	0	.0
Fatal accident investigation	0	.0
Total	0	.0
Grand total	54,477	100.0
	COMBINED FATAL AND NONFATAL ACCIDENTS (32)	
Industry:		
State Worker Compensation benefits	23,359	2.9
Postaccident production loss	0	.0
Primary medical treatment	7,258	.9
Union death or disability benefits	54,458	6.8
Fatal accident investigation	1,881	.2
Total	86,956	10.8
Family: Loss of wages	713,304	88.5
Public sector:		
Federal Social Security benefits	0	.0
Fatal accident investigation	5,744	.7
Total	5,744	7.9
Grand total	806,004	100.0

Table 49.—Cost information relative to electrical accidents¹ in underground metal-nonmetal mines, 1982

Cost to—	Element sum	% of total
Industry:		
State Worker Compensation benefits	\$13,001	37.2
Postaccident production loss	0	.0
Primary medical treatment	8,857	25.3
Union death or disability benefits	38	.1
Fatal accident investigation	0	.0
Total	21,896	62.6
Family: Loss of wages	13,077	37.4
Public sector:		
Federal Social Security benefits	0	.0
Fatal accident investigation	0	.0
Total	0	.0
Grand total	34,973	100.0

¹11 nonfatal accidents; no fatal accidents.

Table 50.—Cost information relative to electrical accidents in underground metal-nonmetal mines, 1983

Cost to—	Element sum	% of total
FATALITIES (1)		
Industry:		
State Worker Compensation benefits	\$89,333	10.5
Postaccident production loss	0	.0
Primary medical treatment	0	.0
Union death or disability benefits	53,750	6.3
Fatal accident investigation	1,130	.1
Total	144,213	16.9
Family: Loss of wages	304,573	35.8
Public sector:		
Federal Social Security benefits	398,346	46.8
Fatal accident investigation	4,161	.5
Total	402,507	47.3
Grand total	851,293	100.0
NONFATAL ACCIDENTS (7)		
Industry:		
State Worker Compensation benefits	1,181	8.5
Postaccident production loss	0	.0
Primary medical treatment	9,008	64.6
Union death or disability benefits	460	3.3
Fatal accident investigation	0	.0
Total	10,649	76.4
Family: Loss of wages	3,288	23.6
Public sector:		
Federal Social Security benefits	0	.0
Fatal accident investigation	0	.0
Total	0	.0
Grand total	13,937	100.0
COMBINED FATAL AND NONFATAL ACCIDENTS (8)		
Industry:		
State Worker Compensation benefits	90,514	10.5
Postaccident production loss	0	.0
Primary medical treatment	9,008	1.0
Union death or disability benefits	54,210	6.3
Fatal accident investigation	1,130	.1
Total	154,862	17.9
Family: Loss of wages	307,861	35.6
Public sector:		
Federal Social Security benefits	398,346	46.0
Fatal accident investigation	4,161	.5
Total	402,507	46.5
Grand total	865,230	100.0

Table 51.—Cost information relative to electrical accidents¹ in underground metal-nonmetal mines, 1984

Cost to-	Element sum	% of total
Industry:		
State Worker Compensation benefits	\$3,920	33.0
Postaccident production loss	0	.0
Primary medical treatment	4,095	34.5
Union death or disability benefits	248	2.1
Fatal accident investigation	0	.0
Total	8,263	69.7
Family: Loss of wages	3,598	30.3
Public sector:		
Federal Social Security benefits	0	.0
Fatal accident investigation	0	.0
Total	0	.0
Grand total	11,861	100.0

¹11 nonfatal accidents; no fatal accidents.

Table 52.—Cost information relative to electrical accidents¹ in underground metal-nonmetal mines, 1985

Cost to-	Element sum	% of total
Industry:		
State Worker Compensation benefits	\$18,145	52.8
Postaccident production loss	0	.0
Primary medical treatment	6,938	20.2
Union death or disability benefits	42	.1
Fatal accident investigation	0	.0
Total	25,125	73.1
Family: Loss of wages	9,231	26.9
Public sector:		
Federal Social Security benefits	0	.0
Fatal accident investigation	0	.0
Total	0	.0
Grand total	34,356	100.0

¹5 nonfatal accidents; no fatal accidents.

Table 53.—Cost Information relative to electrical accidents¹ at the surface at underground metal-nonmetal mines, 1980

Cost to-	Element sum	% of total
Industry:		
State Worker Compensation benefits	\$36,428	64.1
Postaccident production loss	0	.0
Primary medical treatment	10,142	17.9
Union death or disability benefits	150	.3
Fatal accident investigation	0	.0
Total	46,720	82.3
Family: Loss of wages	10,069	17.7
Public sector:		
Federal Social Security benefits	0	.0
Fatal accident investigation	0	.0
Total	0	.0
Grand total	56,789	100.0

¹13 nonfatal accidents; no fatal accidents.

Table 54.—Cost information relative to electrical accidents¹ at the surface at underground metal-nonmetal mines, 1981

Cost to-	Element sum	% of total
Industry:		
State Worker Compensation benefits	\$20,207	54.0
Postaccident production loss	0	.0
Primary medical treatment	1,643	4.4
Union death or disability benefits	319	.9
Fatal accident investigation	0	.0
Total	22,169	59.3
Family: Loss of wages	15,240	40.7
Public sector:		
Federal Social Security benefits	0	.0
Fatal accident investigation	0	.0
Total	0	.0
Grand total	37,409	100.0

¹9 nonfatal accidents; no fatal accidents.

Table 55.—Cost information relative to electrical accidents at the surface at underground metal-nonmetal mines, 1982

Cost to-	Element sum	% of total
FATALITIES (1)		
Industry:		
State Worker Compensation benefits	\$75,146	8.5
Postaccident production loss	0	.0
Primary medical treatment	0	.0
Union death or disability benefits	53,750	6.1
Fatal accident investigation	1,609	.2
Total	130,505	14.8
Family: Loss of wages	745,075	84.7
Public sector:		
Federal Social Security benefits	0	.0
Fatal accident investigation	3,864	.4
Total	3,864	.4
Grand total	879,444	100.0
NONFATAL ACCIDENTS (7)		
Industry:		
State Worker Compensation benefits	14,973	55.9
Postaccident production loss	0	.0
Primary medical treatment	2,200	8.2
Union death or disability benefits	226	.8
Fatal accident investigation	0	.0
Total	17,399	64.9
Family: Loss of wages	9,422	35.1
Public sector:		
Federal Social Security benefits	0	.0
Fatal accident investigation	0	.0
Total	0	.0
Grand total	26,821	100.0
COMBINED FATAL AND NONFATAL ACCIDENTS (8)		
Industry:		
State Worker Compensation benefits	90,119	9.9
Postaccident production loss	0	.0
Primary medical treatment	2,200	.2
Union death or disability benefits	53,976	6.0
Fatal accident investigation	1,609	.2
Total	147,904	16.3
Family: Loss of wages	754,497	83.3
Public sector:		
Federal Social Security benefits	0	.0
Fatal accident investigation	3,864	.4
Total	3,864	.4
Grand total	906,265	100.0

Table 56.-Cost Information relative to electrical accidents at the surface at underground metal-nonmetal mines, 1983

Cost to-	Element sum	% of total
FATALITIES (1)		
Industry:		
State Worker Compensation benefits	\$112,047	13.1
Postaccident production loss	0	.0
Primary medical treatment	0	.0
Union death or disability benefits	53,750	6.3
Fatal accident investigation	2,049	.2
Total	167,846	19.6
Family: Loss of wages	216,947	25.3
Public sector:		
Federal Social Security benefits	465,231	54.3
Fatal accident investigation	6,392	.8
Total	471,623	55.1
Grand total	856,416	100.0
NONFATAL ACCIDENTS (2)		
Industry:		
State Worker Compensation benefits	3,275	23.3
Postaccident production loss	0	.0
Primary medical treatment	1,067	7.6
Union death or disability benefits	698	5.0
Fatal accident investigation	0	.0
Total	5,040	35.9
Family: Loss of wages	9,007	64.1
Public sector:		
Federal Social Security benefits	0	.0
Fatal accident investigation	0	.0
Total	0	.0
Grand total	14,047	100.0
COMBINED FATAL AND NONFATAL ACCIDENTS (3)		
Industry:		
State Worker Compensation benefits	115,322	13.2
Postaccident production loss	0	.0
Primary medical treatment	1,067	7.6
Union death or disability benefits	54,448	6.3
Fatal accident investigation	2,049	.2
Total	172,886	19.9
Family: Loss of wages	225,954	26.0
Public sector:		
Federal Social Security benefits	465,231	53.4
Fatal accident investigation	6,392	.6
Total	471,623	54.1
Grand total	870,463	100.0

Table 57.—Cost information relative to electrical accidents at the surface at underground metal-nonmetal mines, 1984

Cost to—	Element sum	% of total
FATALITIES (2)		
Industry:		
State Worker Compensation benefits	\$162,508	15.5
Postaccident production loss	0	.0
Primary medical treatment	0	.0
Union death or disability benefits	53,750	5.1
Fatal accident investigation	1,545	.1
Total	217,803	20.7
Family: Loss of wages	145,969	13.9
Public sector:		
Federal Social Security benefits	680,158	64.9
Fatal accident investigation	3,531	.5
Total	683,689	65.4
Grand total	1,047,461	100.0
NONFATAL ACCIDENTS (2)		
Industry:		
State Worker Compensation benefits	22,721	89.7
Postaccident production loss	0	.0
Primary medical treatment	2,063	8.1
Union death or disability benefits	177	.7
Fatal accident investigation	0	.0
Total	24,961	98.5
Family: Loss of wages	380	1.5
Public sector:		
Federal Social Security benefits	0	.0
Fatal accident investigation	0	.0
Total	0	.0
Grand total	25,341	100.0
COMBINED FATAL AND NONFATAL ACCIDENTS (4)		
Industry:		
State Worker Compensation benefits	185,229	17.3
Postaccident production loss	0	.0
Primary medical treatment	2,063	.2
Union death or disability benefits	53,927	5.0
Fatal accident investigation	1,545	.2
Total	242,764	22.7
Family: Loss of wages	146,349	13.6
Public sector:		
Federal Social Security benefits	680,158	63.4
Fatal accident investigation	3,531	.3
Total	683,689	63.7
Grand total	1,072,802	100.0

Table 58.—Cost information relative to electrical accidents at the surface at underground metal-nonmetal mines, 1985

Cost to—	Element sum	% of total
	FATALITIES (1)	
Industry:		
State Worker Compensation benefits	\$90,972	56.2
Postaccident production loss	0	.0
Primary medical treatment	0	.0
Union death or disability benefits	64,500	39.9
Fatal accident investigation	1,241	.8
Total	156,713	96.9
Family: Loss of wages	0	.0
Public sector:		
Federal Social Security benefits	0	.0
Fatal accident investigation	5,065	3.1
Total	5,065	3.1
Grand total	161,778	100.0
NONFATAL ACCIDENTS (1)		
Industry:		
State Worker Compensation benefits	0	.0
Postaccident production loss	0	.0
Primary medical treatment	398	51.6
Union death or disability benefits	126	16.3
Fatal accident investigation	0	.0
Total	524	68.0
Family: Loss of wages	247	32.0
Public sector:		
Federal Social Security benefits	0	.0
Fatal accident investigation	0	.0
Total	0	.0
Grand total	771	100.0
COMBINED FATAL AND NONFATAL ACCIDENTS (2)		
Industry:		
State Worker Compensation benefits	90,972	56.0
Postaccident production loss	0	.0
Primary medical treatment	398	.2
Union death or disability benefits	64,626	39.8
Fatal accident investigation	1,241	.8
Total	157,237	96.7
Family: Loss of wages	247	.2
Public sector:		
Federal Social Security benefits	0	.0
Fatal accident investigation	5,065	3.1
Total	5,065	3.1
Grand total	162,549	100.0

CONCLUSIONS

The most common activities resulting in an electrical injury in all four mining sectors investigated are electrical repair and maintenance. Electricians and mechanics suffered the most injuries with the part of the body most affected being the hand or body systems³ in the case of nonfatal injuries, and electrocutions being the cause of all fatal injuries. For all four mining sectors combined, the average age of fatal accident victims was 35 and the average age of nonfatal accident victims was 36.

Of the 1,142 fatal and nonfatal accidents analyzed, 63% of the victims had 0 to 5 years of experience at the specific job they were performing when the accident occurred. One means of reducing electrical accidents may involve more frequent, more extensive training for employees with this level of experience.

Some safety experts believe that the single most important technique for bringing about safe worker behavior is training. Formal safety training programs play a vital role in many companies in a wide range of U.S. industries. Firms that continue safety efforts in a systematic and thorough fashion have been rewarded with substantial reductions in lost hours of work. The money saved usually more than justifies the cost of the safety training programs (3).

Successful training programs focus on two interrelated phases: (1) knowledge of safe operating procedures and (2) a positive attitude toward safety. Employees may be trained in the proper method of performing electrical repair and maintenance on a piece of equipment; however, if their attitude toward safety is negative, this knowledge may not prevent them from becoming involved in a potentially fatal accident. On the other hand, if employees are not properly trained in performing their specific job function, a positive attitude toward safety may still not prevent an accident from occurring.

Whatever techniques are employed, active management support of safety is a key dimension in the success of any safety program. Unless employees perceive that the organizational climate is highly supportive of safety on the job, the most sophisticated safety program will not be maximally effective. Management at all levels of supervision

must demonstrate that safety is a responsibility that everyone must actively share. Employees should maintain a continuing interest and constant awareness of the importance of following safe working practices.

Some guidelines and recommendations that have been suggested from various sources as possible means of reducing electrical fatalities include the following:

1. Frequent electrical safety presentations explaining the hazards of working on energized equipment (4).
2. Annual refresher training (4).
3. Warning posters and stickers relating to specific problems (4).
4. Implementation of a program to ensure that only well-trained and knowledgeable personnel involved in electrical repair and maintenance are performing electrical work (4).
5. Close inspection of trailing cables at the beginning of each shift (5).
6. Use of cable handling devices and protective gloves when appropriate (5).
7. Use of shielded low-voltage trailing cables to prevent shock exposure when handling trailing cables and splices by confining the shock hazard within the cable jacket (5).
8. Use of ground-fault circuit interrupters that will shut off the current before a serious shock occurs (6).
9. Use of the most appropriate tool for the job being performed (6).
10. Provision of adequate clearance in the working quarters to prevent worker fatigue (6).
11. Use of portable, stepdown transformers in certain locations so that a low voltage (6, 12, 24, or 32 volts) electrical system may be installed (6).
12. Use of insulating platforms, rubber mats, and rubber gloves when tools are being used in wet locations (6).
13. Proper use of double-insulated tools and three-wire tools (6).
14. Regular tool inspection (6).
15. Clean power tools regularly (6).
16. Eliminate overhead lines (7).
17. Limit access or raise overhead lines (7).
18. Provide cardiopulmonary resuscitation (CPR) training (7).
19. Insist on adherence to safe working procedures by first-line supervisors (3).

³The body system classification applies when the function of the entire body has been affected, without specific injury to any other part. It does not apply when the system damage results from an external injury affecting an external part such as a back injury that includes damage to the nerves of the spinal cord.

REFERENCES

1. Di Canio, D. G. Analysis of Economic Impact of Fatal/Nonfatal Accidents in Surface Coal and Metal/Nonmetal Mines (contract J0113005, SRI Int.). BuMines OFR 206-84, 1983, 145 pp.; NTIS PB 85-145787.
2. _____. Accident Cost Indicator Model Reference and User Manual (contract J0113005, SRI Int.). BuMines OFR 207-84, 1983, 148 pp.; NTIS PB 85-145795.
3. Cohen, A., M. J. Smith, and W. K. Anger. Self-Protective Measures Against Workplace Hazards. *J. Saf. Res.*, v. 11, 1979, pp. 121-131.
4. Hall, P. M. An Electrical Fatality Prevention Program for the Coal Mining Industry. Paper in Proceedings of The Seventh WVU Mining Electrotechnology Conference, West Virginia University, July 24-27, 1984, pp. 231-243.
5. Reynolds, R. L. History of Coal Mine Electrical Fatalities Since 1970. Paper in Proceedings of The Seventh WVU Mining Electrotechnology Conference, West Virginia University, July 24-27, 1984, pp. 213-230.
6. Lahey, J. Electrically Safe Tools, Choosing and Using Them. *Natl. Saf. News*, July 1980, pp. 45-46.
7. Yenckek, M. R. The Bureau of Mines Shock Prevention Research Program, An Overview. Paper in Proceedings of The Seventh WVU Mining Electrotechnology Conference, West Virginia University, July 24-27, 1984, pp. 244-256.

BIBLIOGRAPHY

- Bowers, E. T. Using ADA (Accident Data Analysis) in Mine Safety Research. BuMines OFR 72-86, 1986, 111 pp.
- Schultz, D. P., and S. E. Schultz. Psychology and Industry Today. Macmillan, 4th ed., 1986, pp. 462-464.

- Zohar, D. Safety Climate in Industrial Organizations: Theoretical and Applied Implications. *J. Appl. Psychol.*, No. 65, 1980, pp. 96-102.

APPENDIX A.—DESCRIPTION OF INFORMATION CATEGORIES AND DEFINITION OF NONFATAL ACCIDENTS AS USED IN THIS REPORT

INFORMATION CATEGORIES

<i>Category</i>	<i>Description</i>
Activity engaged in when accident occurred.	Specific activity at time of injury.
Source of injury	The item that directly inflicted injury.
Job title	The individual's occupation.
Mining method	The mining method being used.
Location	The specific location of accident.
Machine	The machine (equipment), if listed, involved in accident.
Nature of injury	The injury in terms of its principle physical characteristics.
Accident type	The event that resulted in injury.
Part of body	Identifies part of body injured in accident.

NONFATAL ACCIDENTS

Nonfatal accidents, as defined in this report, include accidents resulting in the following:

- Permanent total or permanent partial disability.
- Days away from work only.
- Days away from work and days of restricted activity.
- Days of restricted work activity only.
- Injuries that do not result in death, nor days away from work, nor days of restricted work activity.

APPENDIX B.—VISUAL REPRESENTATIONS OF INFORMATION

The following figures present data contained in the tables in the main text concerning fatal and nonfatal electrical accidents in mining for the 1980-85 period. For those information categories with extensive detail only data for the first 10 entries are included. The following is a breakdown of the information presented in the figures.

Figure B-1 (table 2).—Fatal electrical accidents in underground coal mines, by activity engaged in when accident occurred, by source of injury, by job title, by mining method, by location, and by machine.

Figure B-2 (table 6).—Nonfatal electrical accidents in underground coal mines, by activity engaged in when accident occurred, by source of injury, by job title, by mining method, by location, by nature of injury, by accident type, and by part of body.

Figure B-3 (table 11).—Fatal electrical accidents at the surface at underground coal mines, by activity engaged in

when fatality occurred, by source of injury, by job title, and by machine.

Figure B-4 (table 15).—Nonfatal electrical accidents at the surface at underground coal mines, by activity engaged in when accident occurred, by source of injury, by job title, by machine, by nature of injury, by accident type, and by part of body.

Figure B-5 (table 22).—Nonfatal electrical accidents in underground metal-nonmetal mines, by activity engaged in when accident occurred, by source of injury, by job title, by machine, by nature of injury, by part of body, by source of injury, and by job title.

Figure B-6 (table 31).—Nonfatal electrical accidents at the surface at underground metal-nonmetal mines, by activity engaged in when accident occurred, by source of injury, by job title, by machine, by nature of injury, by accident type, and by part of body.

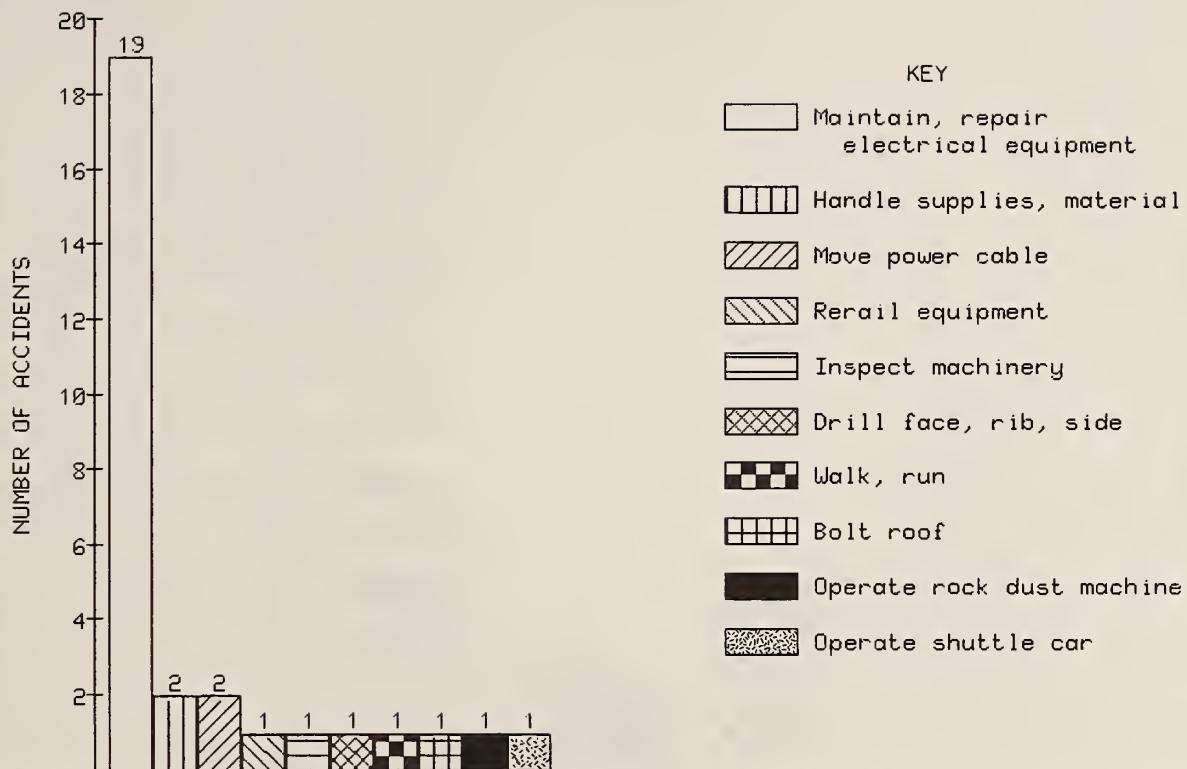


Figure B-1.-Fatal electrical accidents in underground coal mines, 1980-85. Activity engaged in when accident occurred.

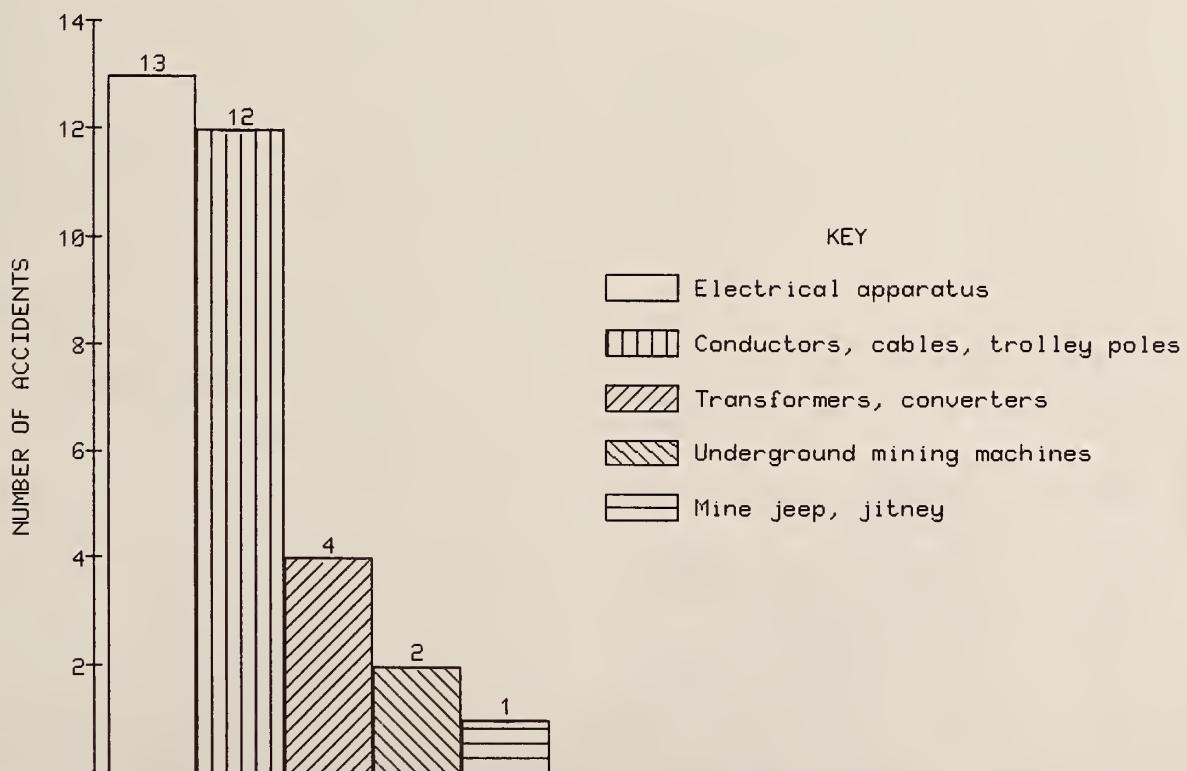


Figure B-1.-Fatal electrical accidents in underground coal mines, 1980-85-Continued. Source of Injury.

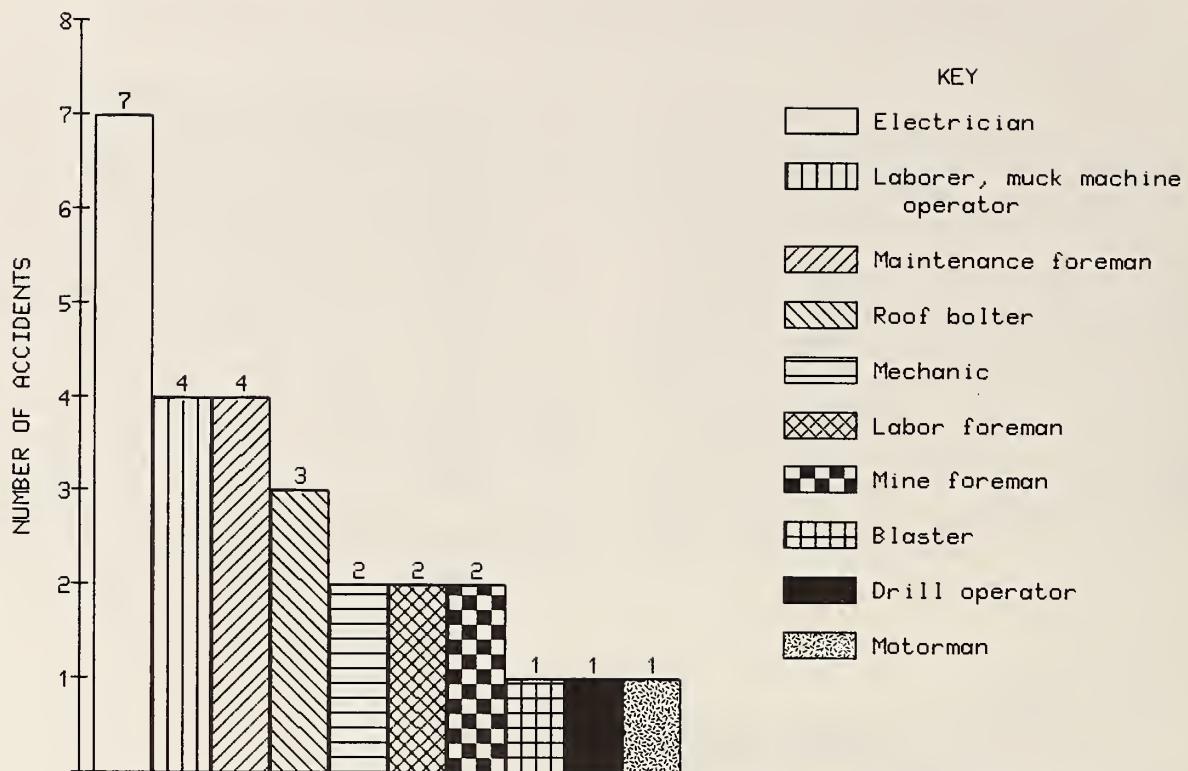


Figure B-1.-Fatal electrical accidents in underground coal mines, 1980-85—Continued. Job title.

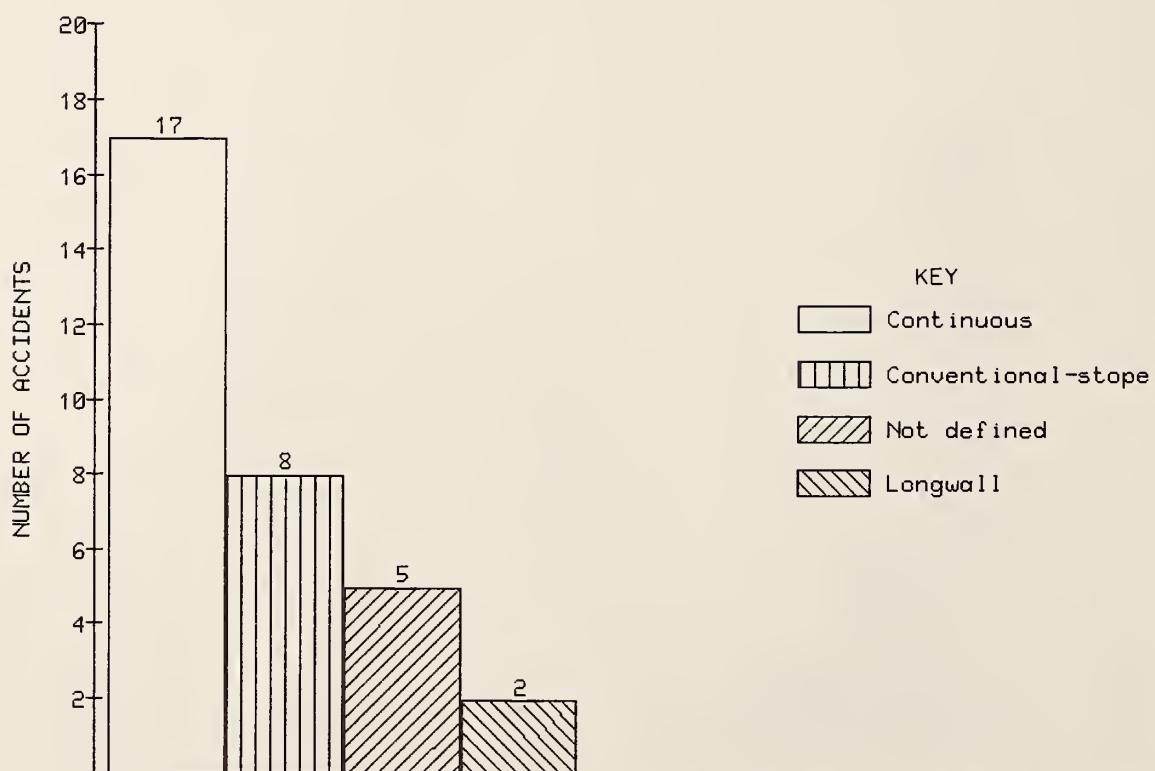


Figure B-1.-Fatal electrical accidents in underground coal mines, 1980-85—Continued. Mining method.



Figure B-1.-Fatal electrical accidents in underground coal mines, 1980-85-Continued. Location.

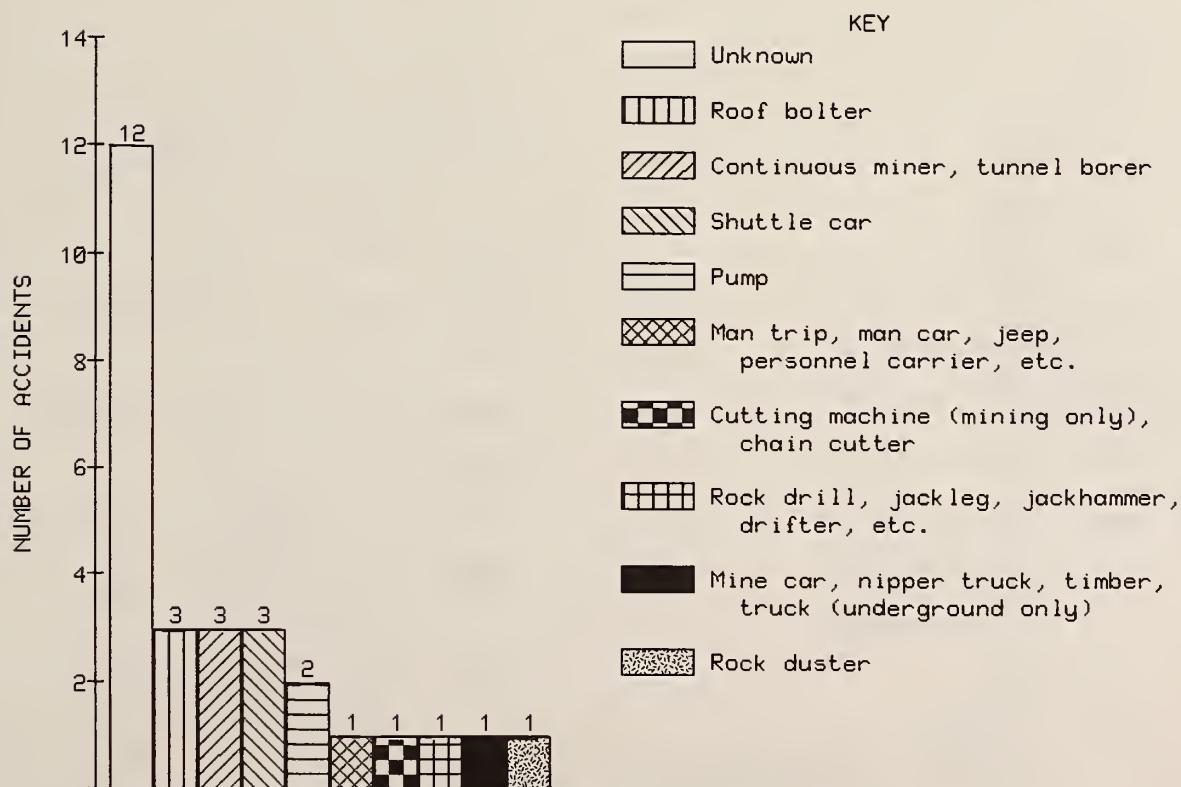


Figure B-1.-Fatal electrical accidents in underground coal mines, 1980-85-Continued. Machine.

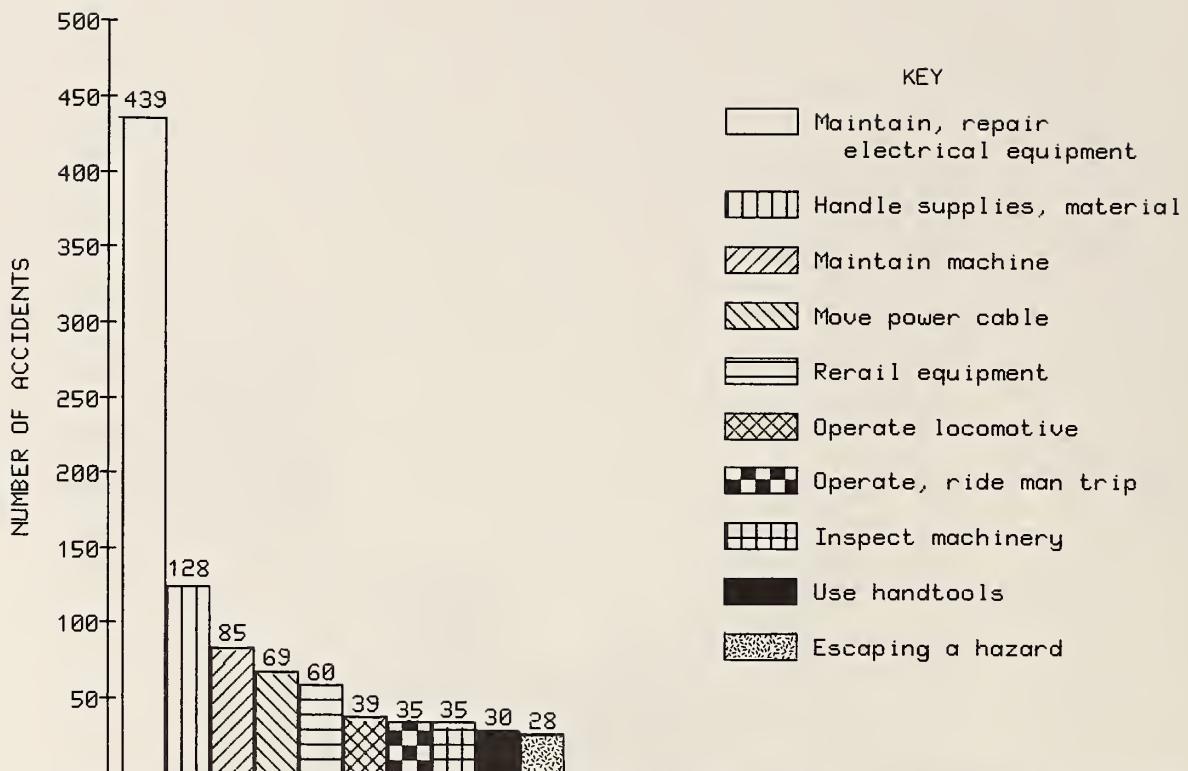


Figure B-2.-Nonfatal electrical accidents in underground coal mines, 1980-85. Activity engaged in when accident occurred.

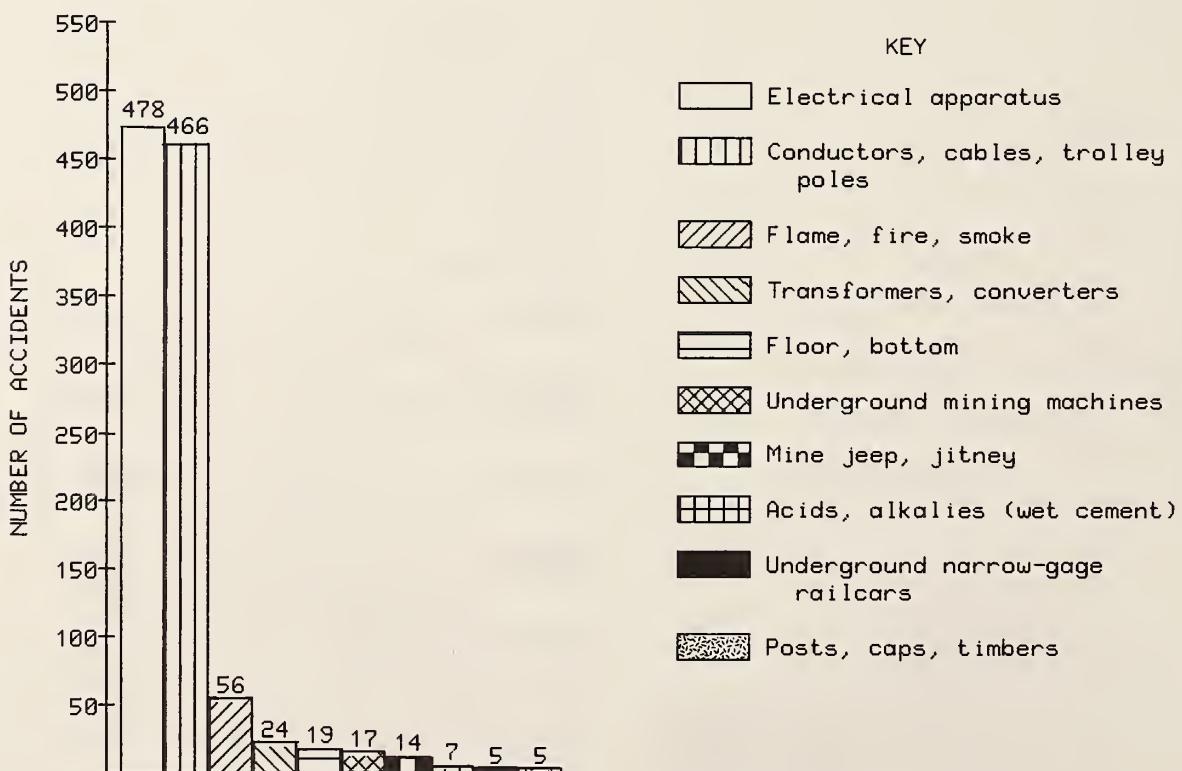


Figure B-2.-Nonfatal electrical accidents in underground coal mines, 1980-85-Continued. Source of Injury.

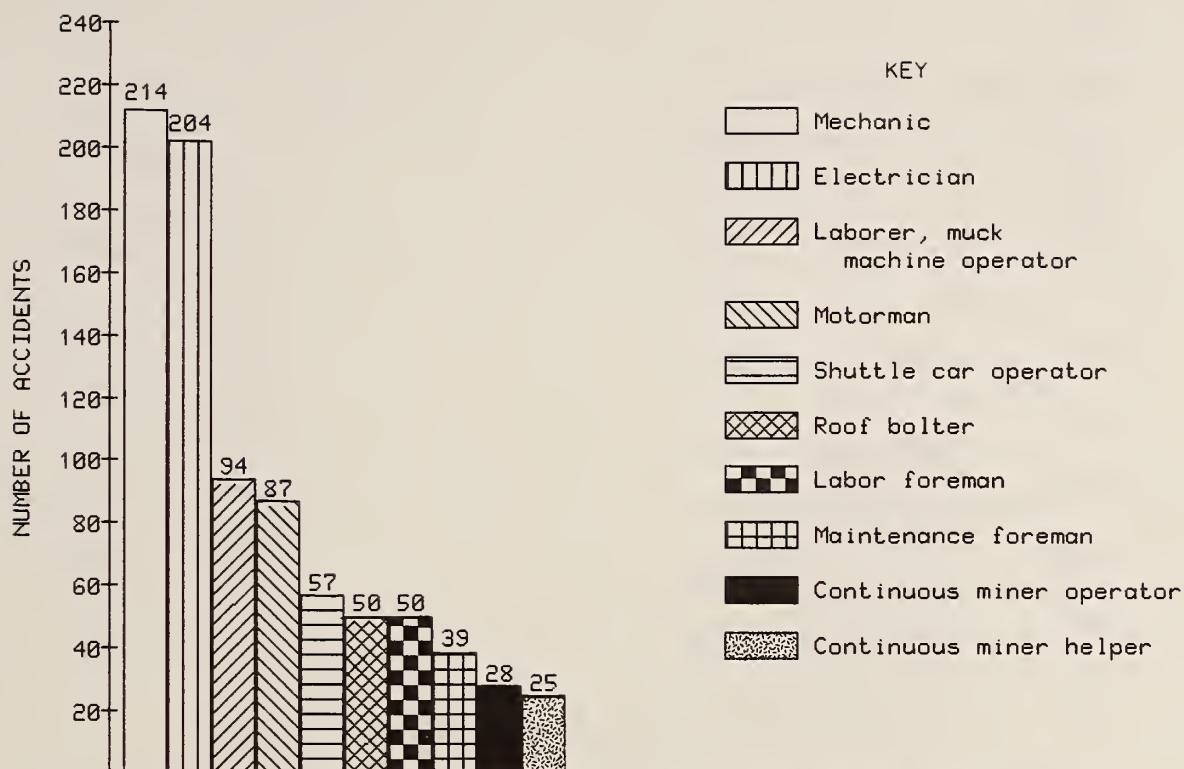


Figure B-2.-Nonfatal electrical accidents in underground coal mines, 1980-85-Continued. Job title.



Figure B-2.-Nonfatal electrical accidents in underground coal mines, 1980-85-Continued. Mining method.

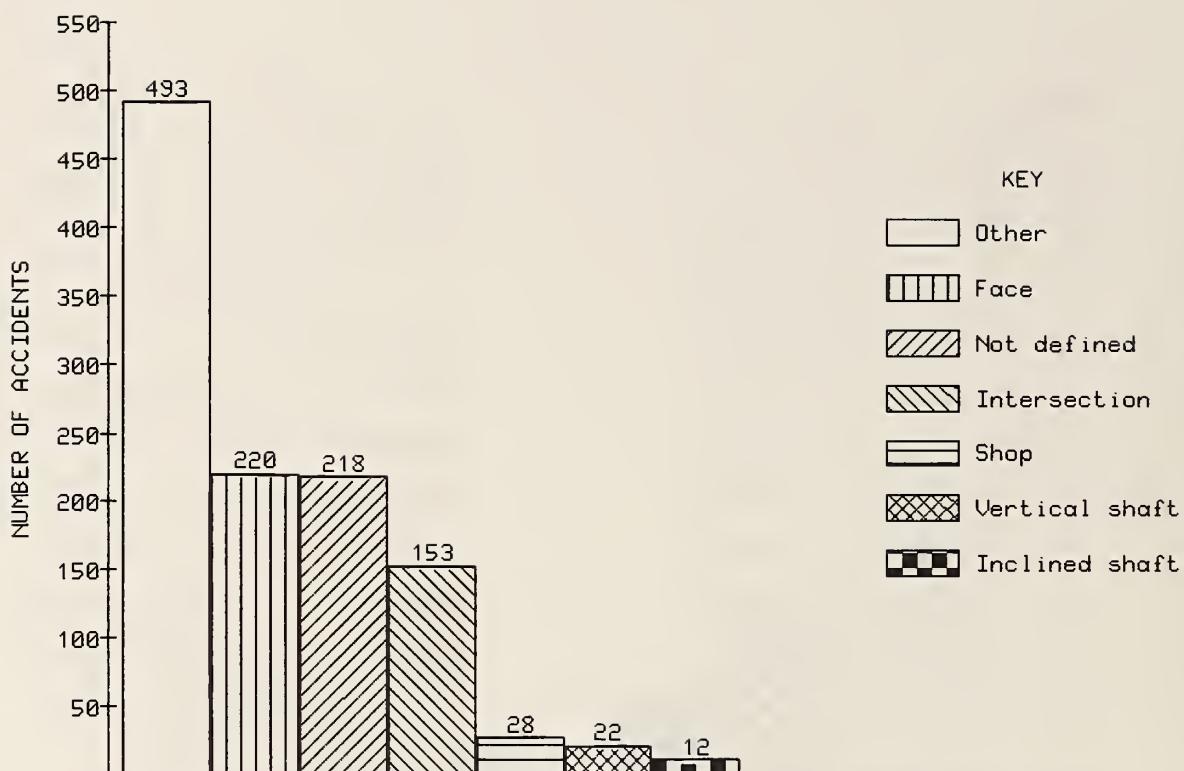


Figure B-2.-Nonfatal electrical accidents in underground coal mines, 1980-85-Continued. Location.

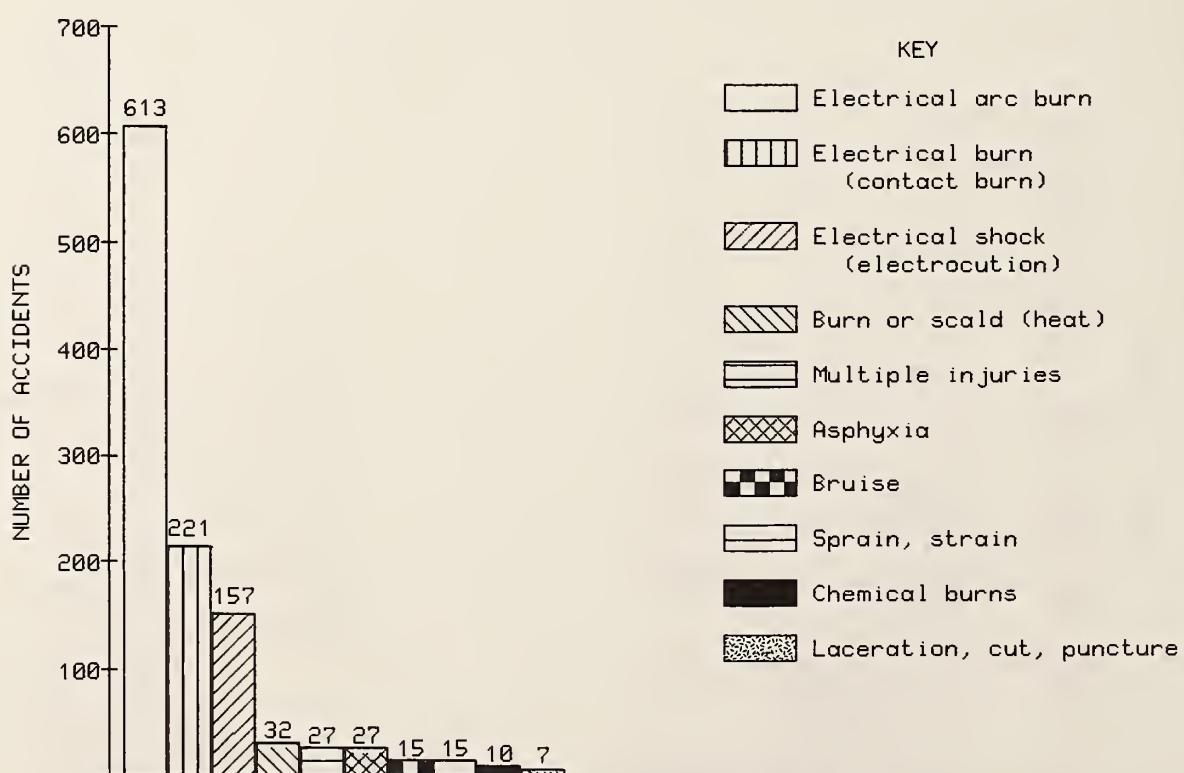


Figure B-2.-Nonfatal electrical accidents in underground coal mines, 1980-85-Continued. Nature of injury.

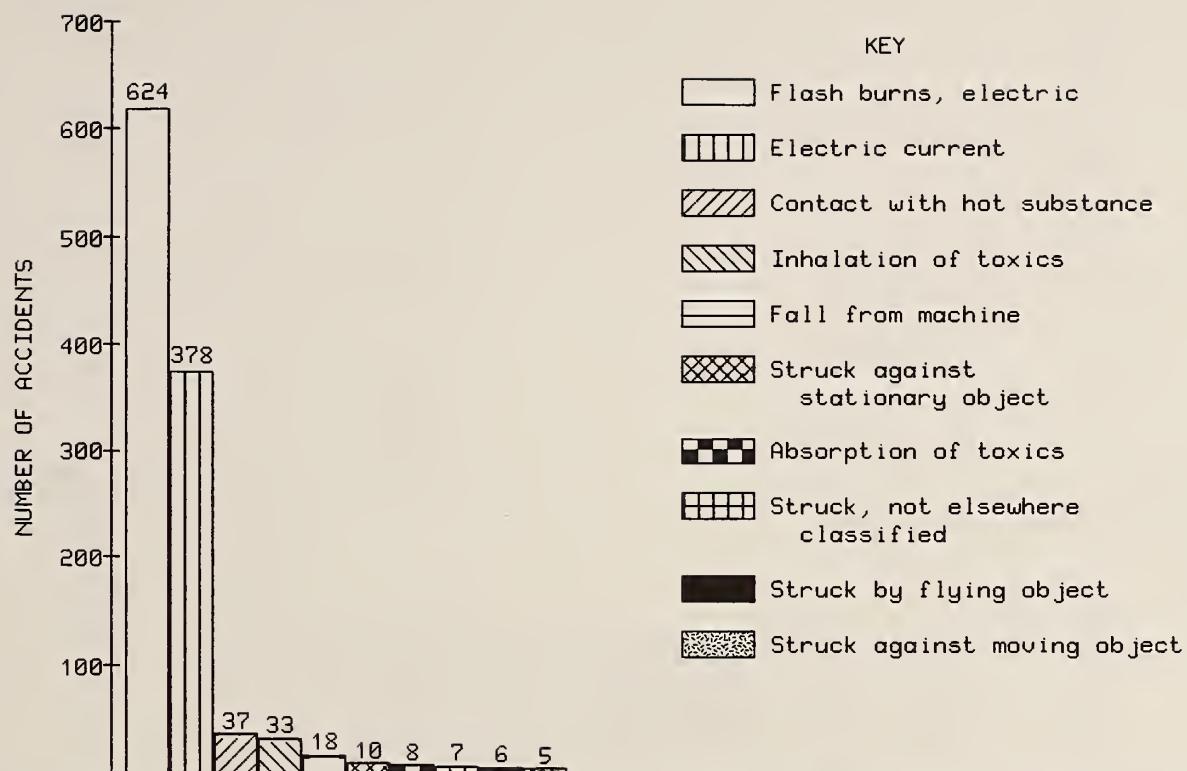


Figure B-2.-Nonfatal electrical accidents in underground coal mines, 1980-85—Continued. Accident type.

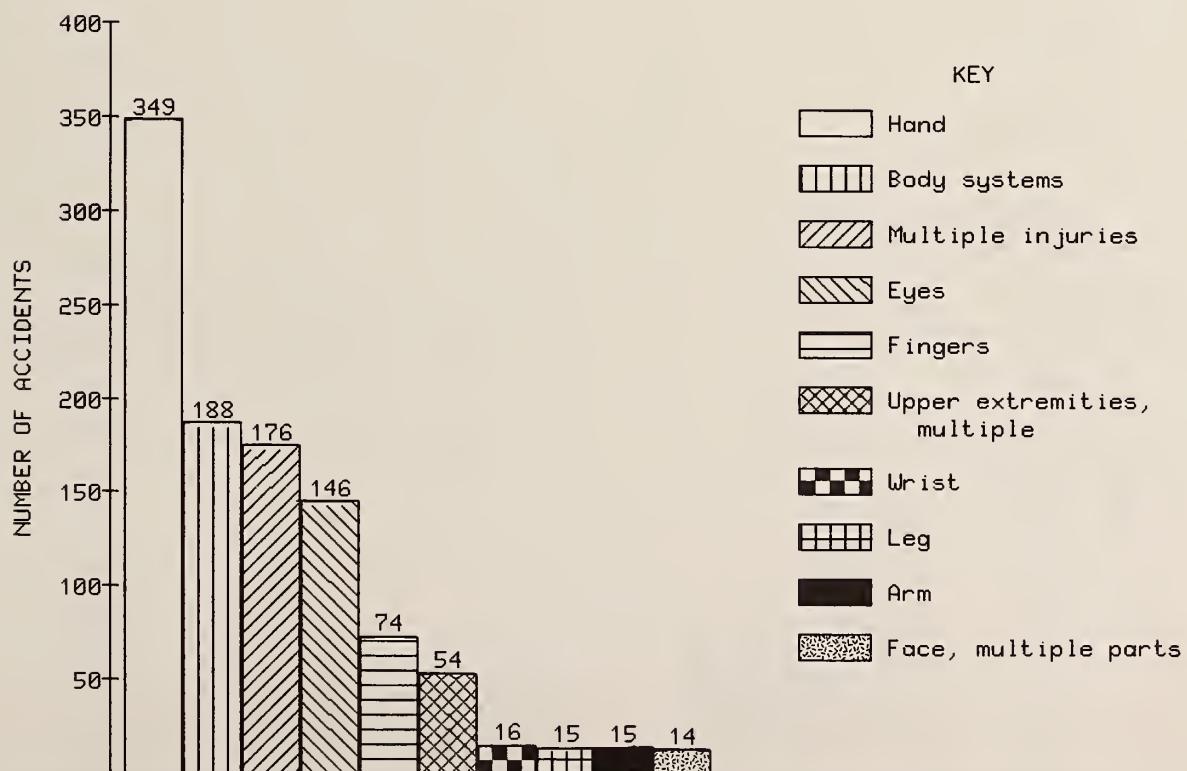


Figure B-2.-Nonfatal electrical accidents in underground coal mines, 1980-85—Continued. Part of body.

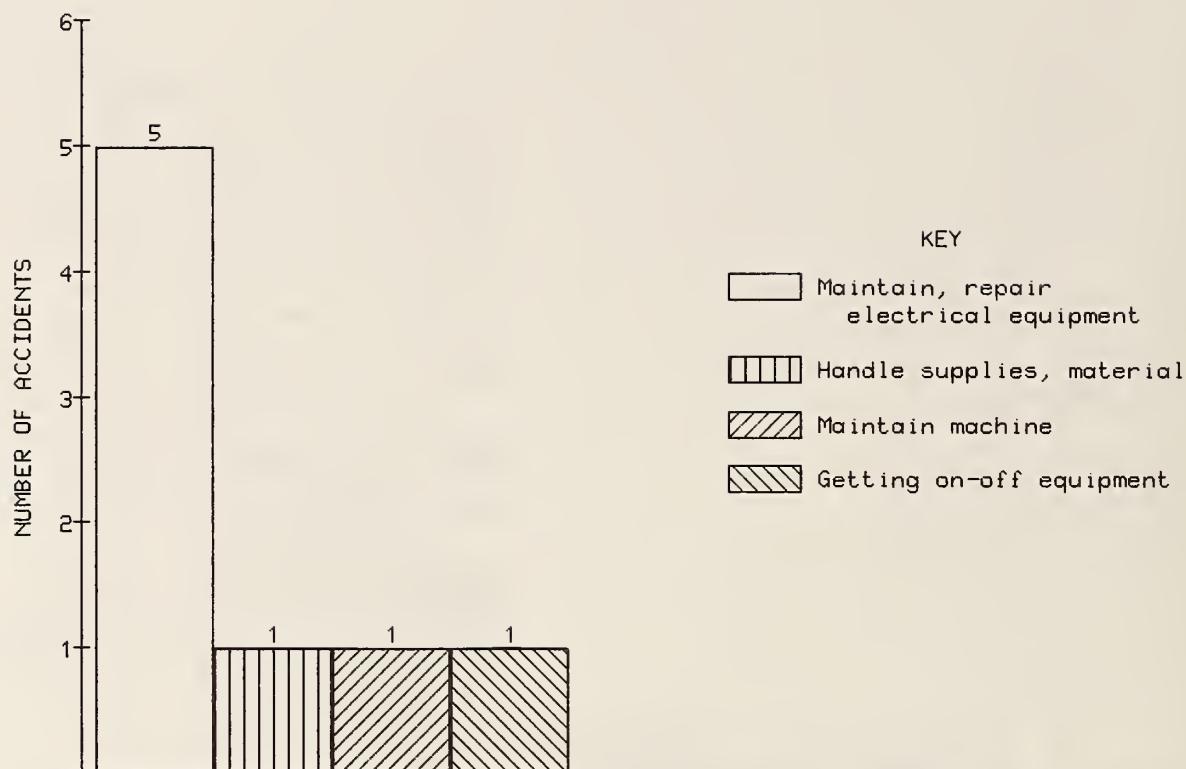


Figure B-3.-Fatal electrical accidents at the surface at underground coal mines, 1980-85. Activity engaged in when fatality occurred.

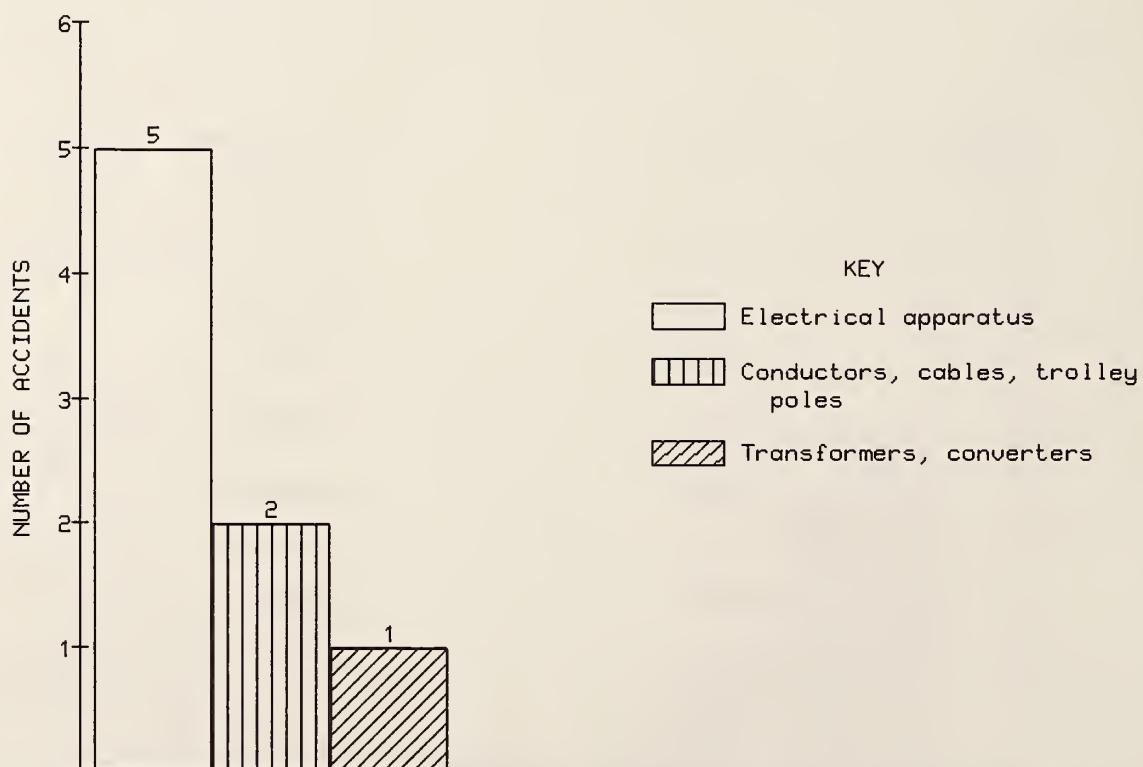


Figure B-3.-Fatal electrical accidents at the surface at underground coal mines, 1980-85-Continued. Source of Injury.

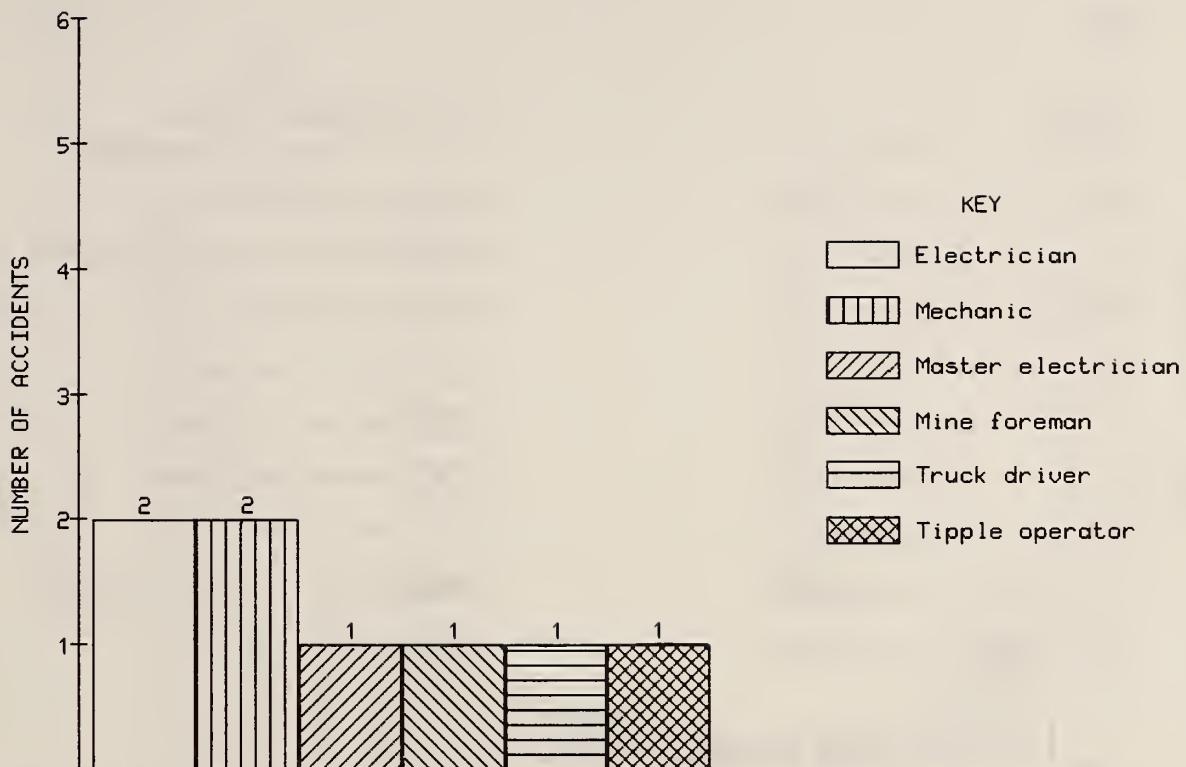


Figure B-3.-Fatal electrical accidents at the surface at underground coal mines, 1980-85-Continued. Job title.

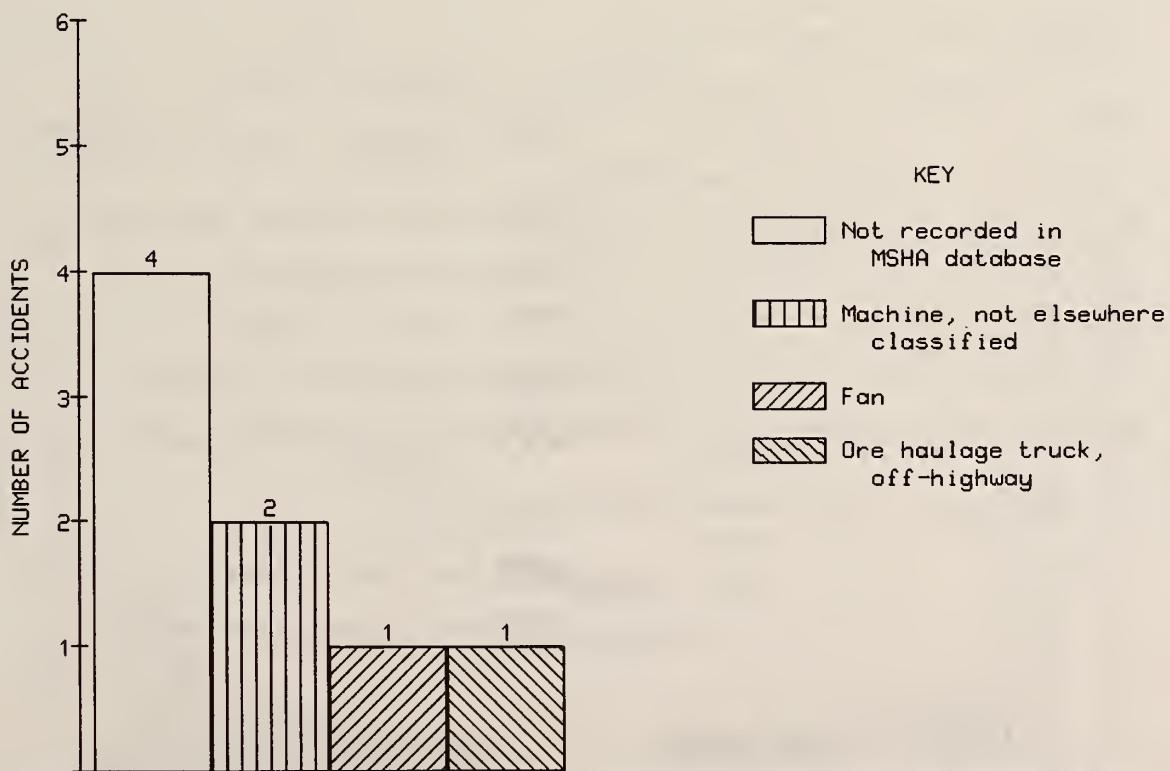


Figure B-3.-Fatal electrical accidents at the surface at underground coal mines, 1980-85-Continued. Machine.

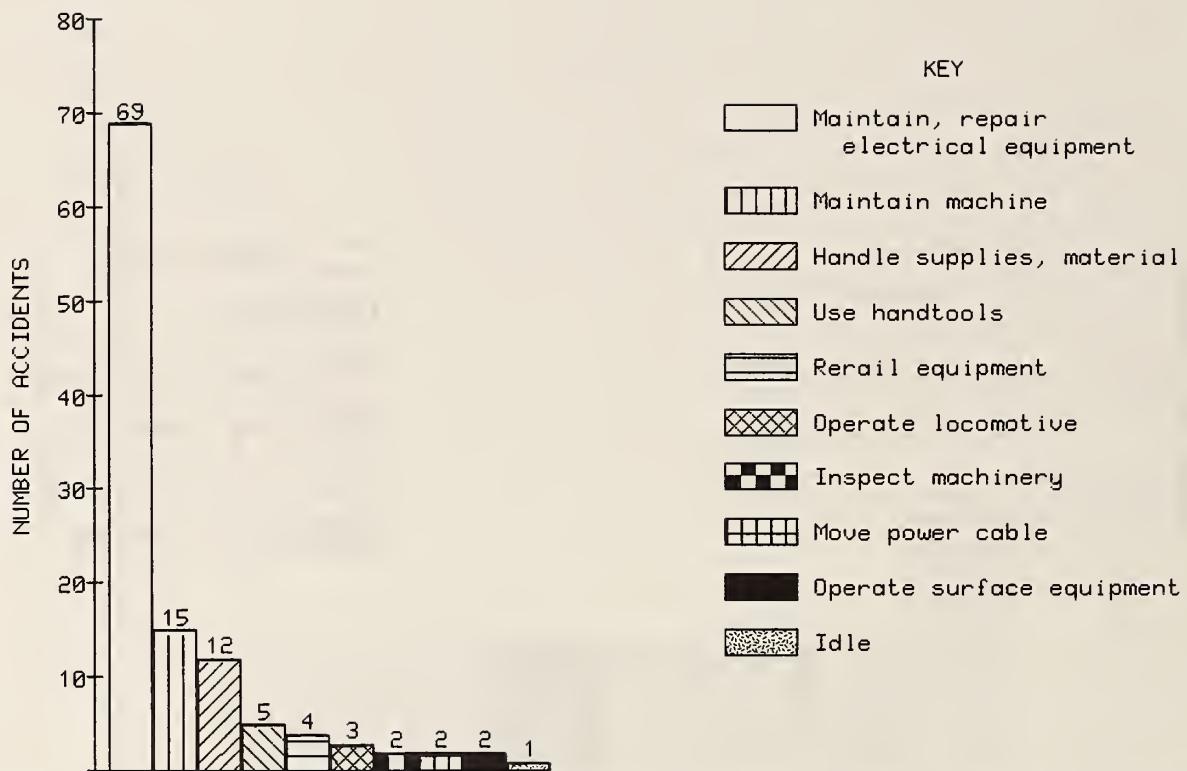


Figure B-4.-Nonfatal electrical accidents at the surface at underground coal mines, 1980-85. Activity engaged in when accident occurred.

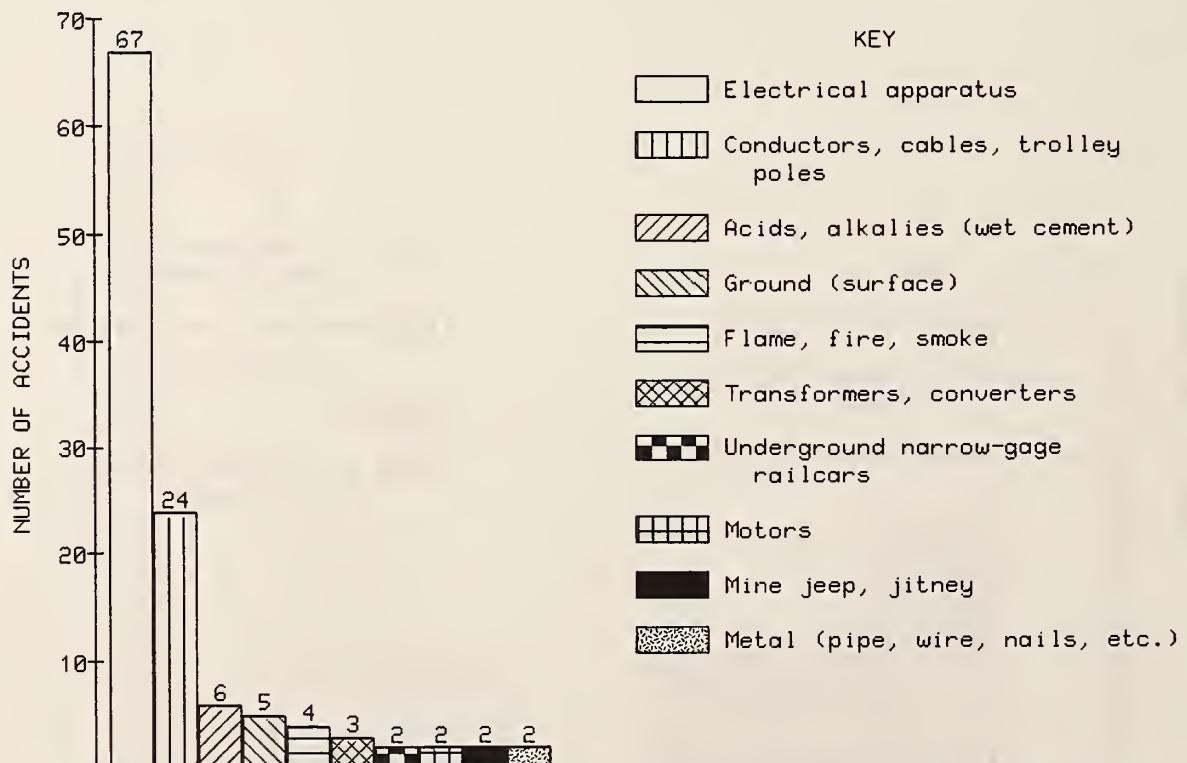


Figure B-4.-Nonfatal electrical accidents at the surface at underground coal mines, 1980-85-Continued. Source of Injury.

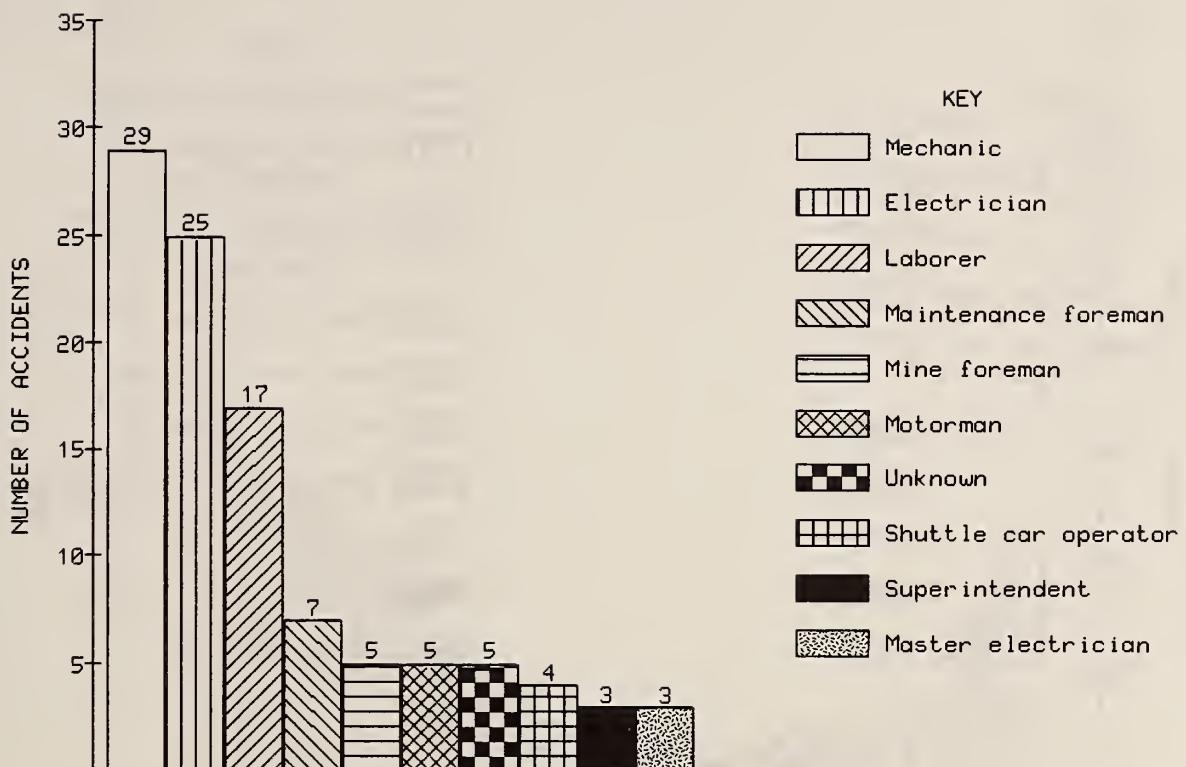


Figure B-4.-Nonfatal electrical accidents at the surface at underground coal mines, 1980-85-Continued. Job title.

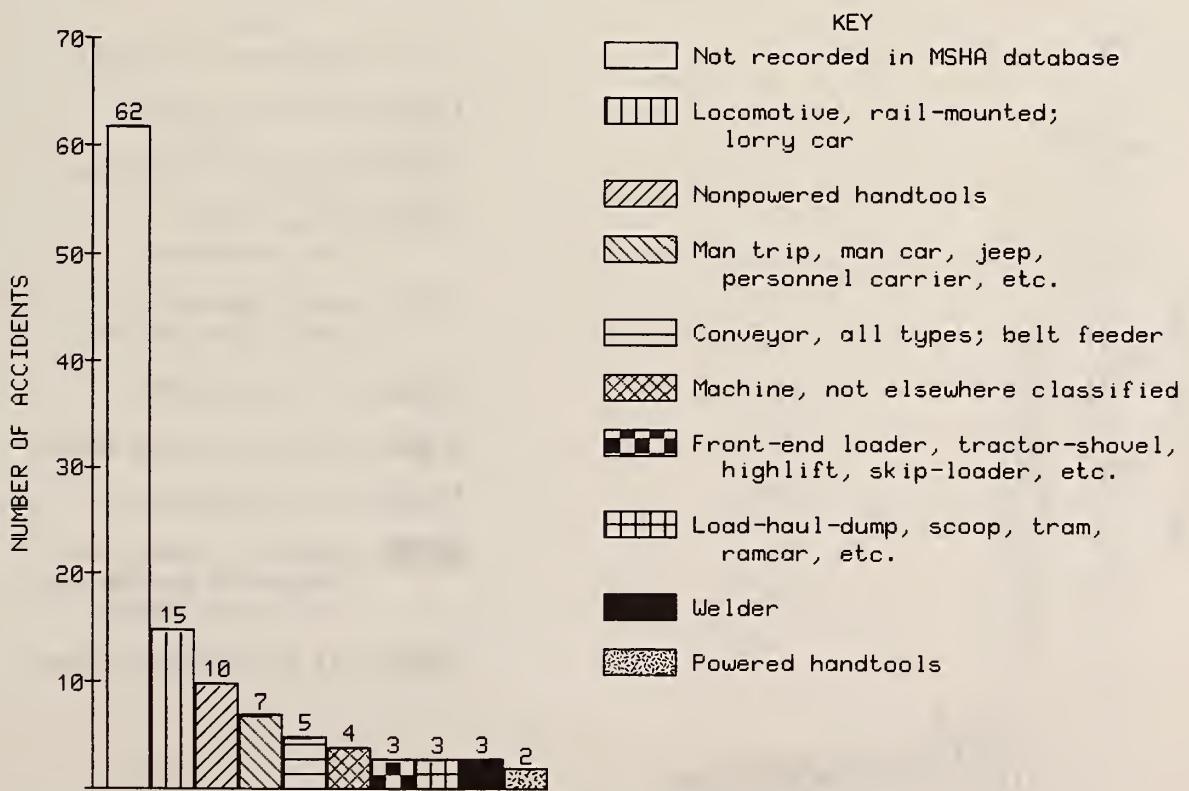


Figure B-4.-Nonfatal electrical accidents at the surface at underground coal mines, 1980-85-Continued. Machine.

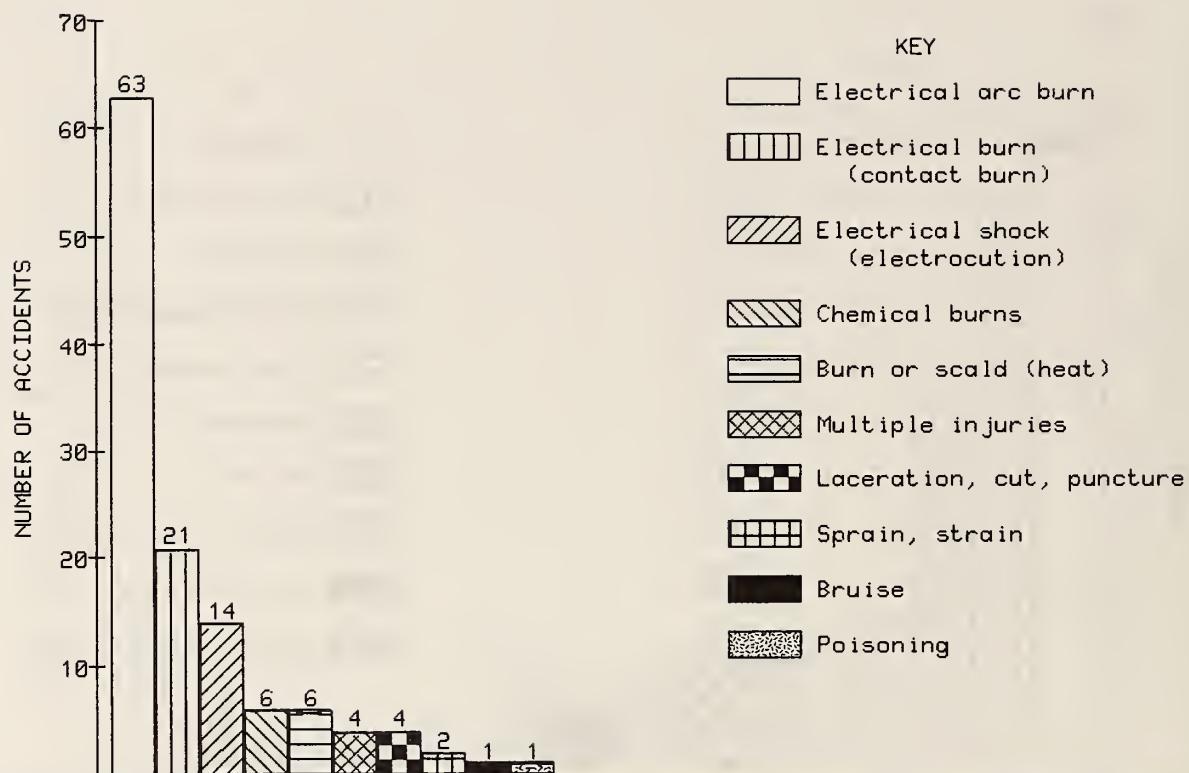


Figure B-4.-Nonfatal electrical accidents at the surface at underground coal mines, 1980-85-Continued. Nature of injury.

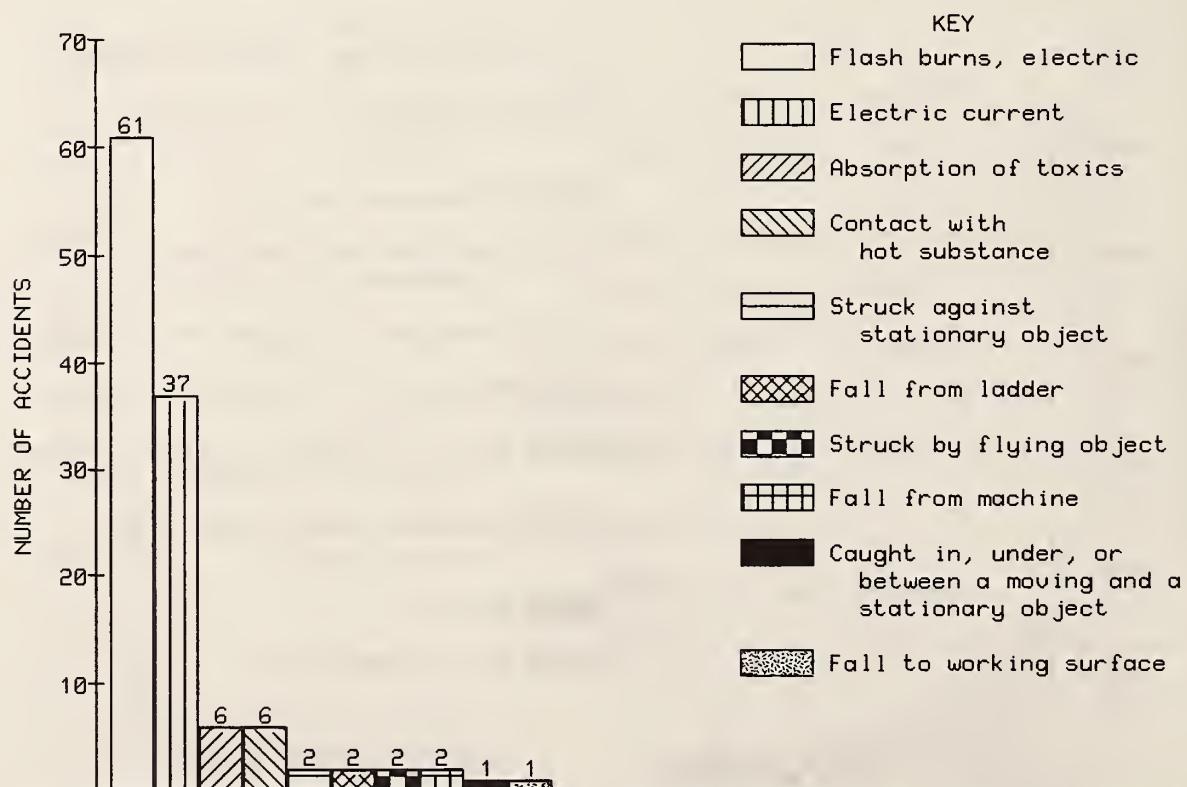


Figure B-4.-Nonfatal electrical accidents at the surface at underground coal mines, 1980-85-Continued. Accident type.

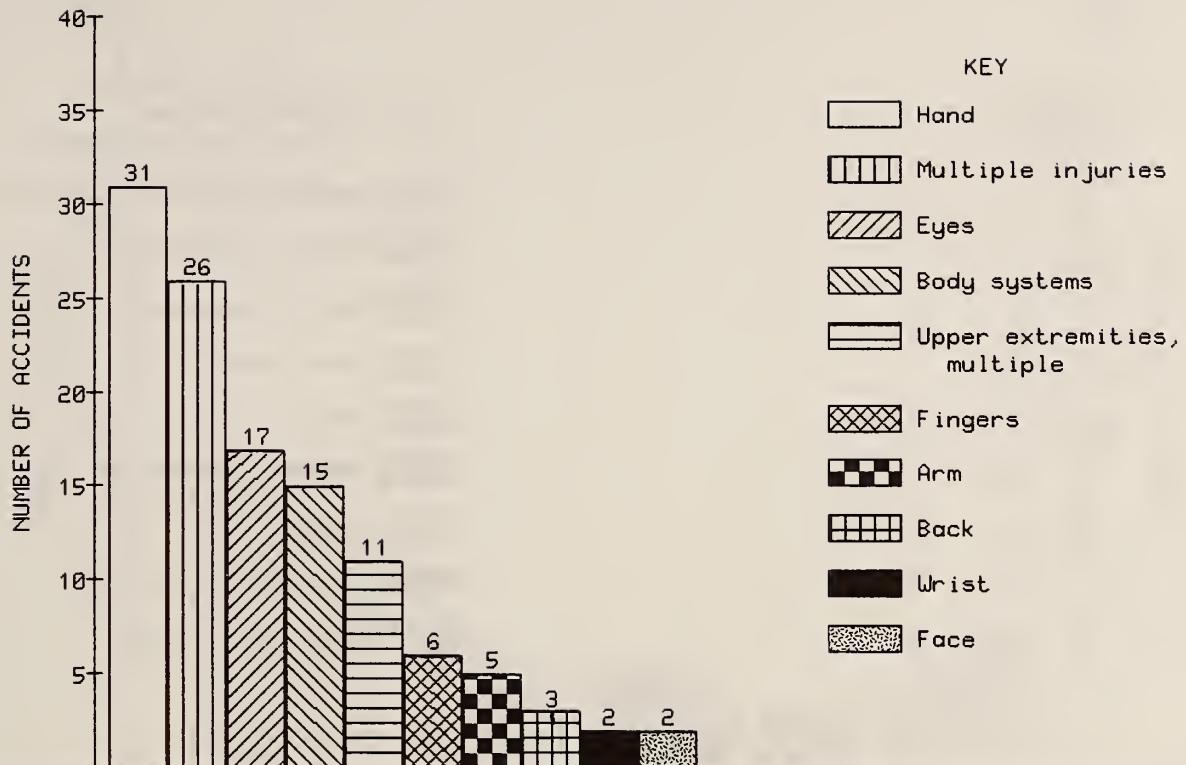


Figure B-4.-Nonfatal electrical accidents at the surface at underground coal mines, 1980-85-Continued. Part of body.

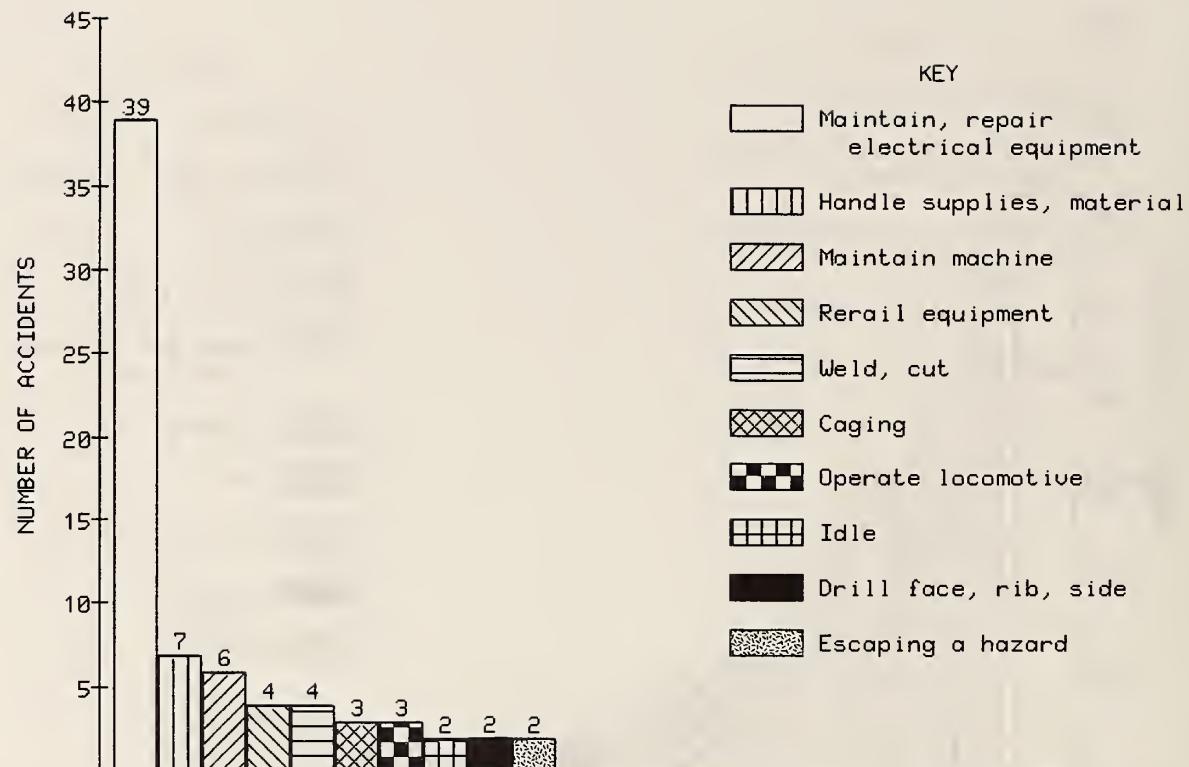


Figure B-5.-Nonfatal electrical accidents in underground metal-nonmetal mines, 1980-85. Activity engaged in when accident occurred.

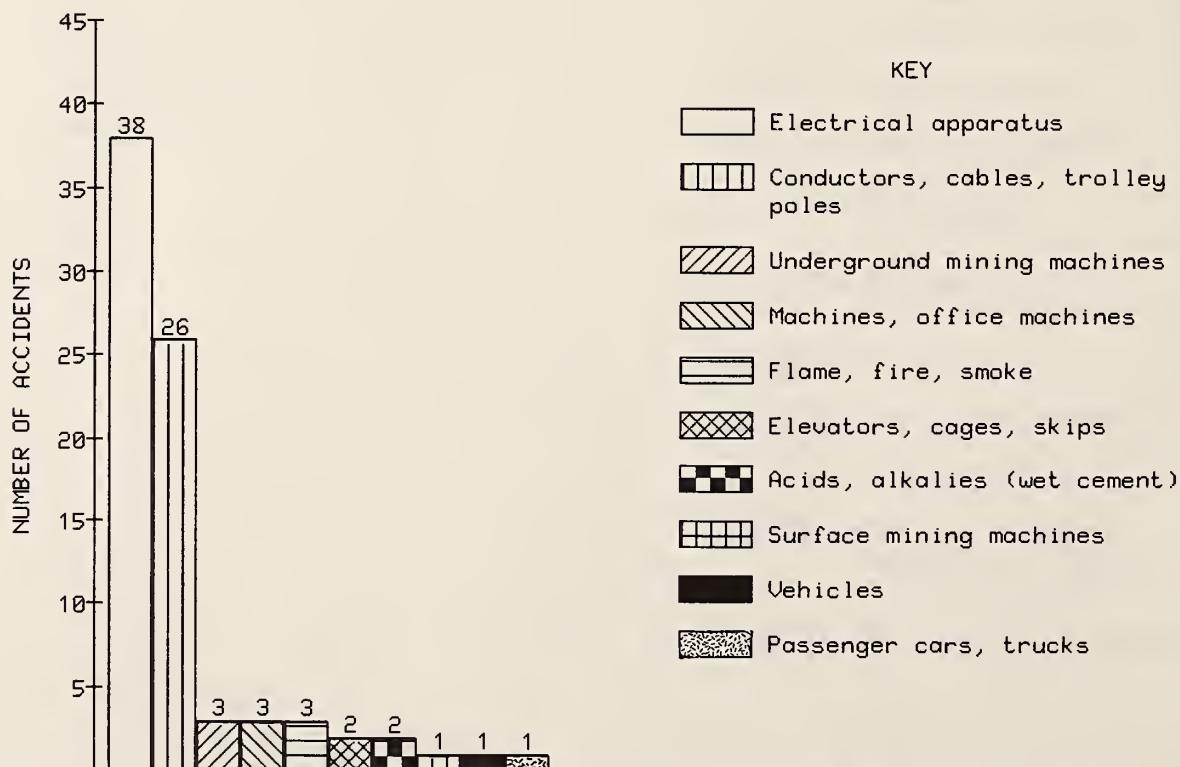


Figure B-5.-Nonfatal electrical accidents in underground metal-nonmetal mines, 1980-85-Continued. Source of Injury.

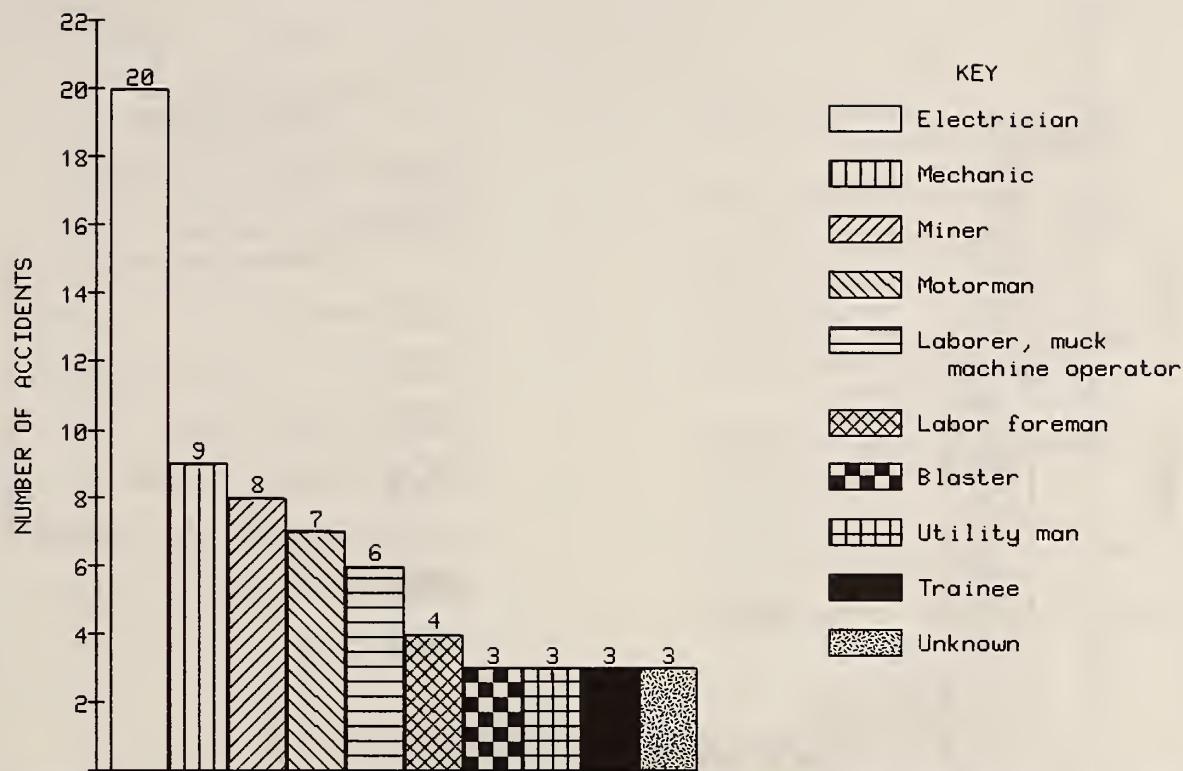


Figure B-5.-Nonfatal electrical accidents in underground metal-nonmetal mines, 1980-85-Continued. Job title.

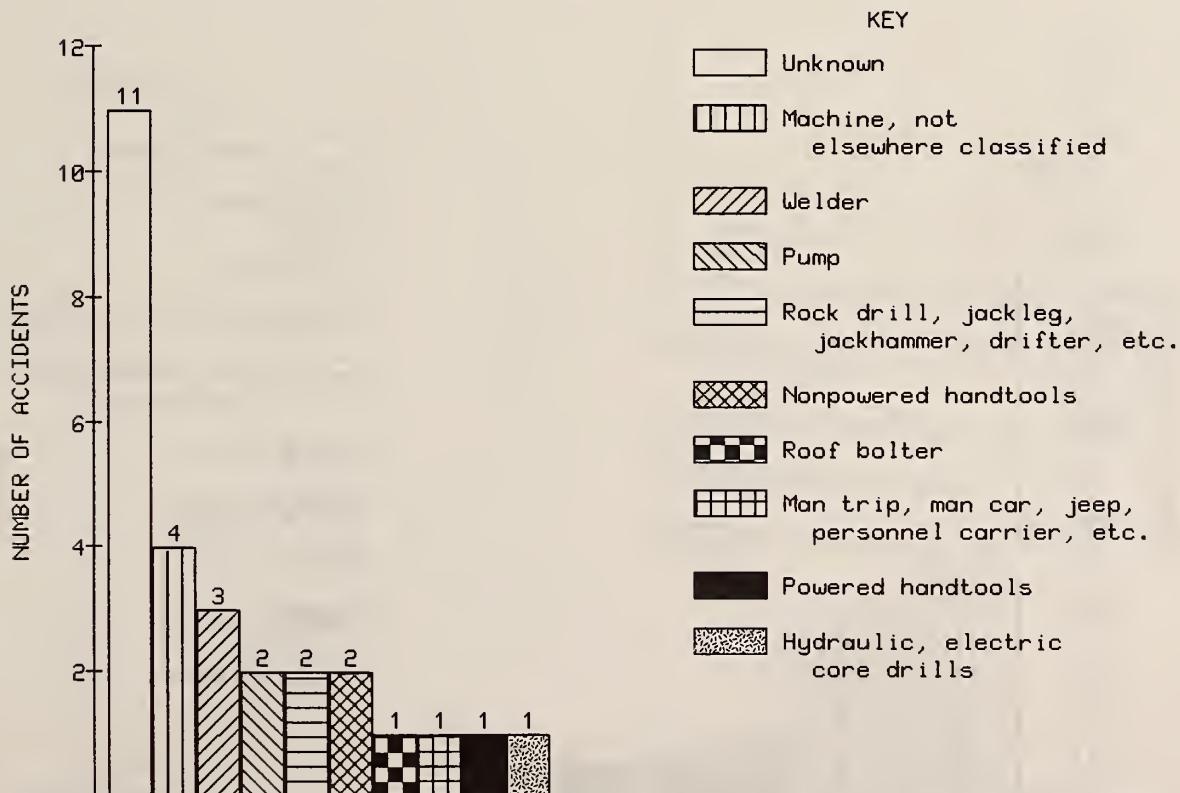


Figure B-5.-Nonfatal electrical accidents in underground metal-nonmetal mines, 1980-85-Continued. Machine.

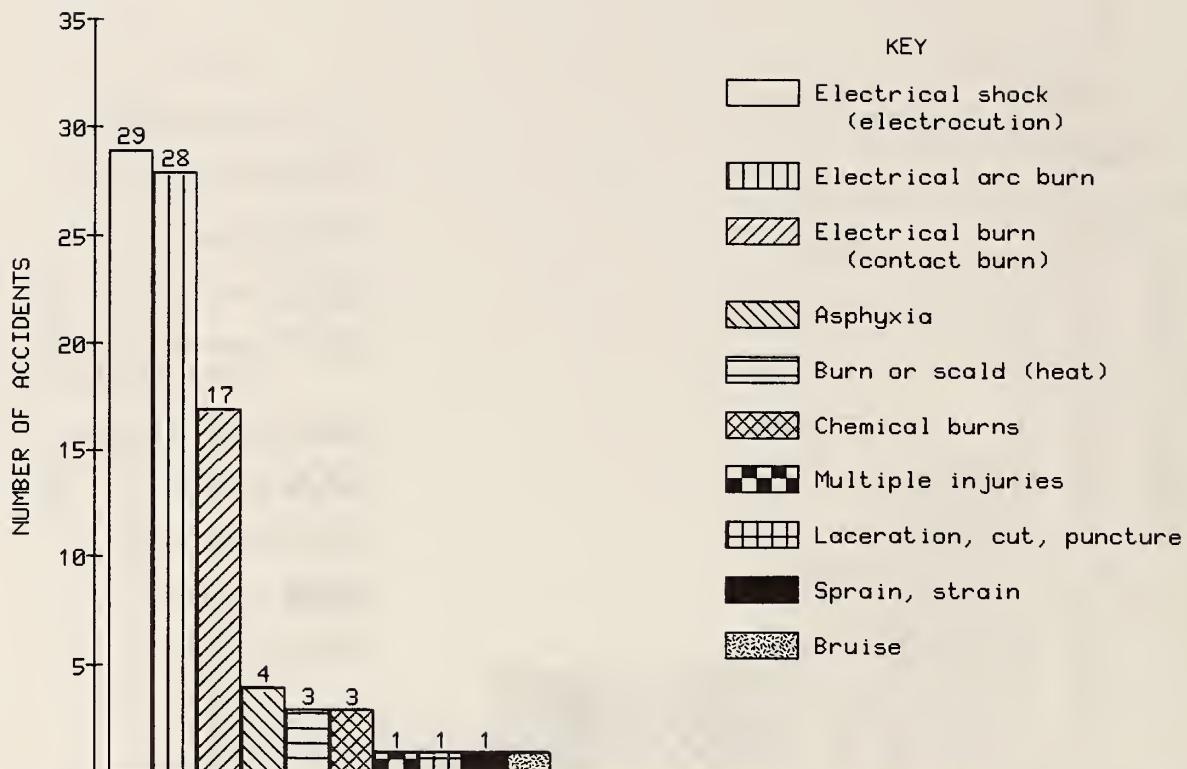


Figure B-5.—Nonfatal electrical accidents in underground metal-nonmetal mines, 1980-85—Continued. Nature of injury.

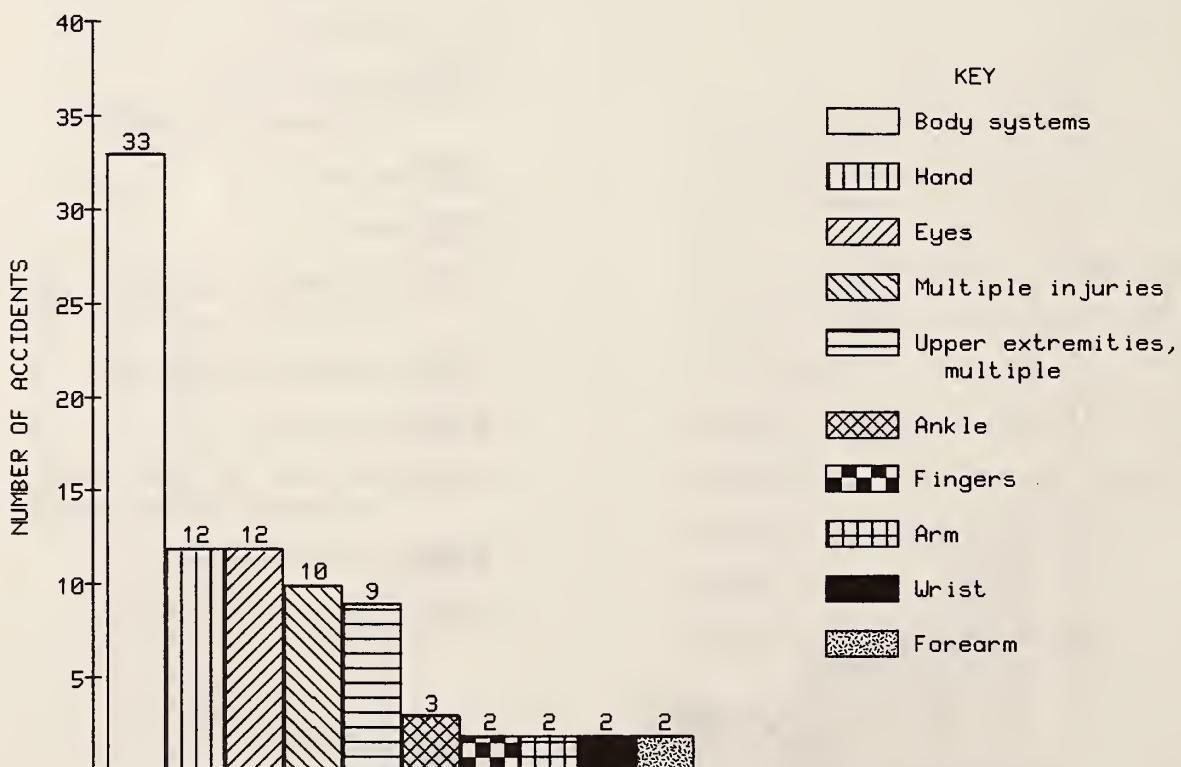


Figure B-5.—Nonfatal electrical accidents in underground metal-nonmetal mines, 1980-85—Continued. Part of body.

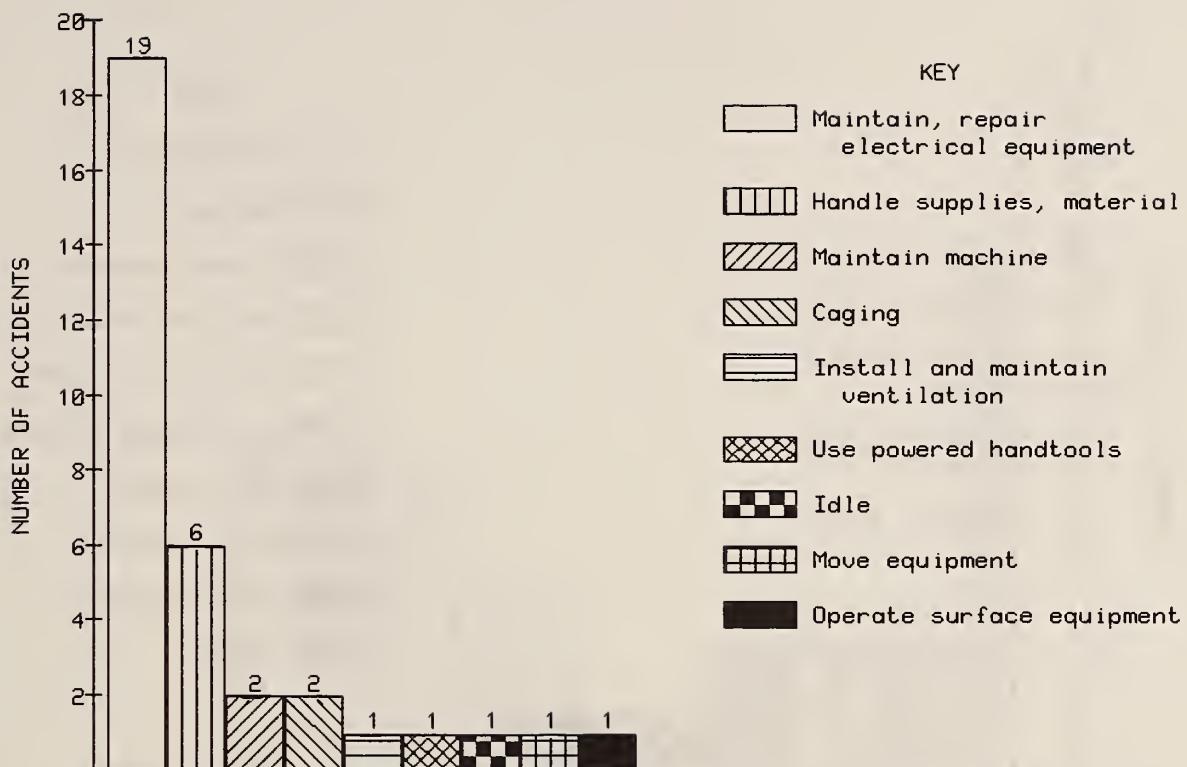


Figure B-6.-Nonfatal electrical accidents at the surface at underground metal-nonmetal mines, 1980-85. Activity engaged in when accident occurred.

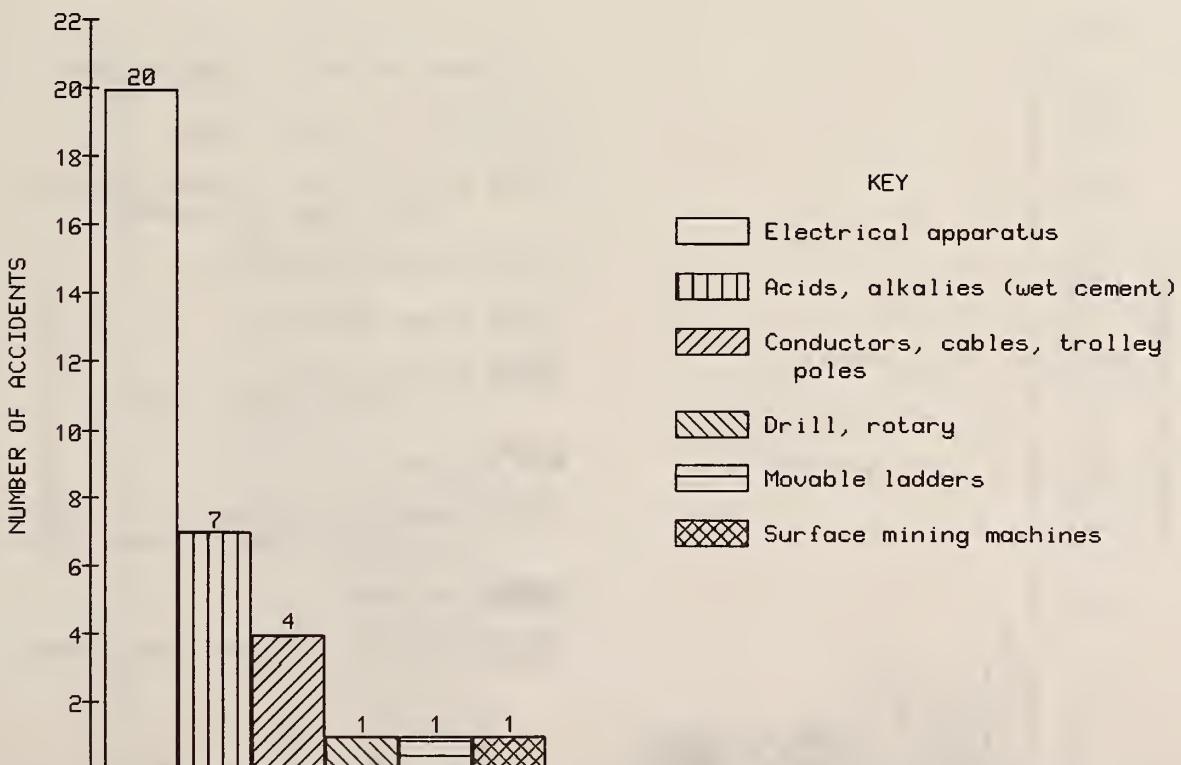


Figure B-6.-Nonfatal electrical accidents at the surface at underground metal-nonmetal mines, 1980-85-Continued.
Source of injury.

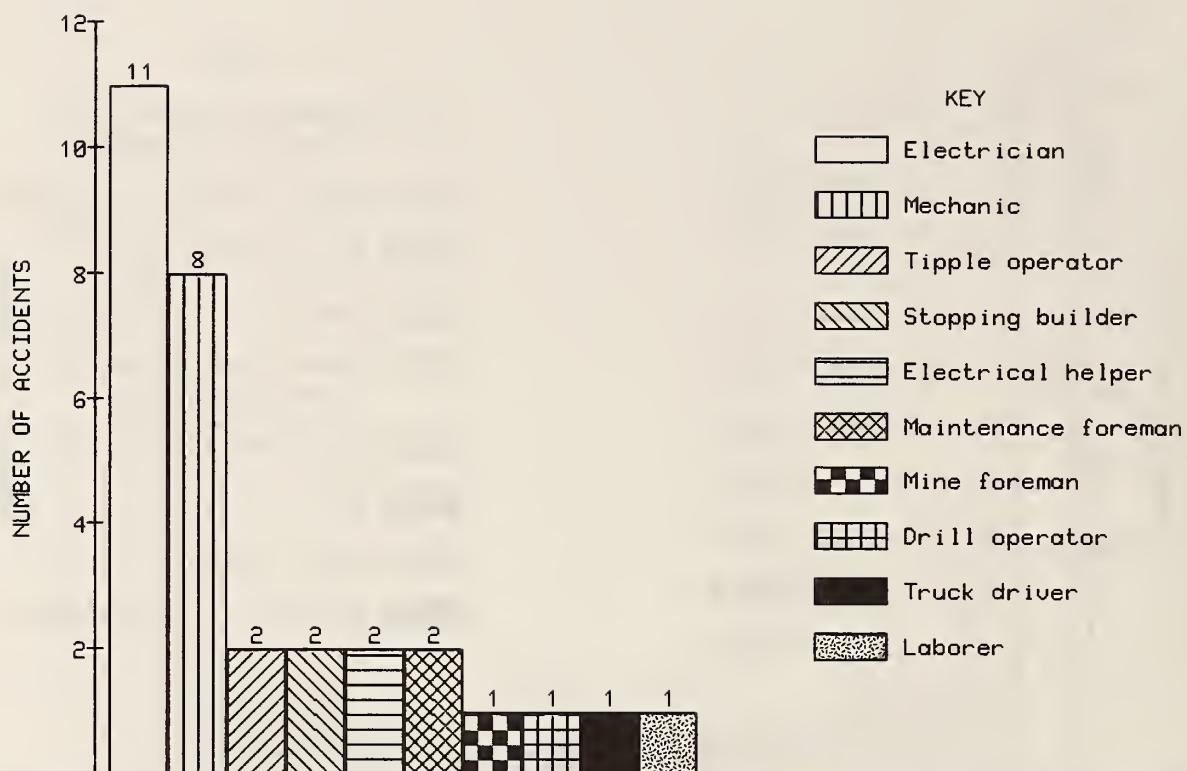


Figure B-6.-Nonfatal electrical accidents at the surface at underground metal-nonmetal mines, 1980-85-Continued.
Job title.

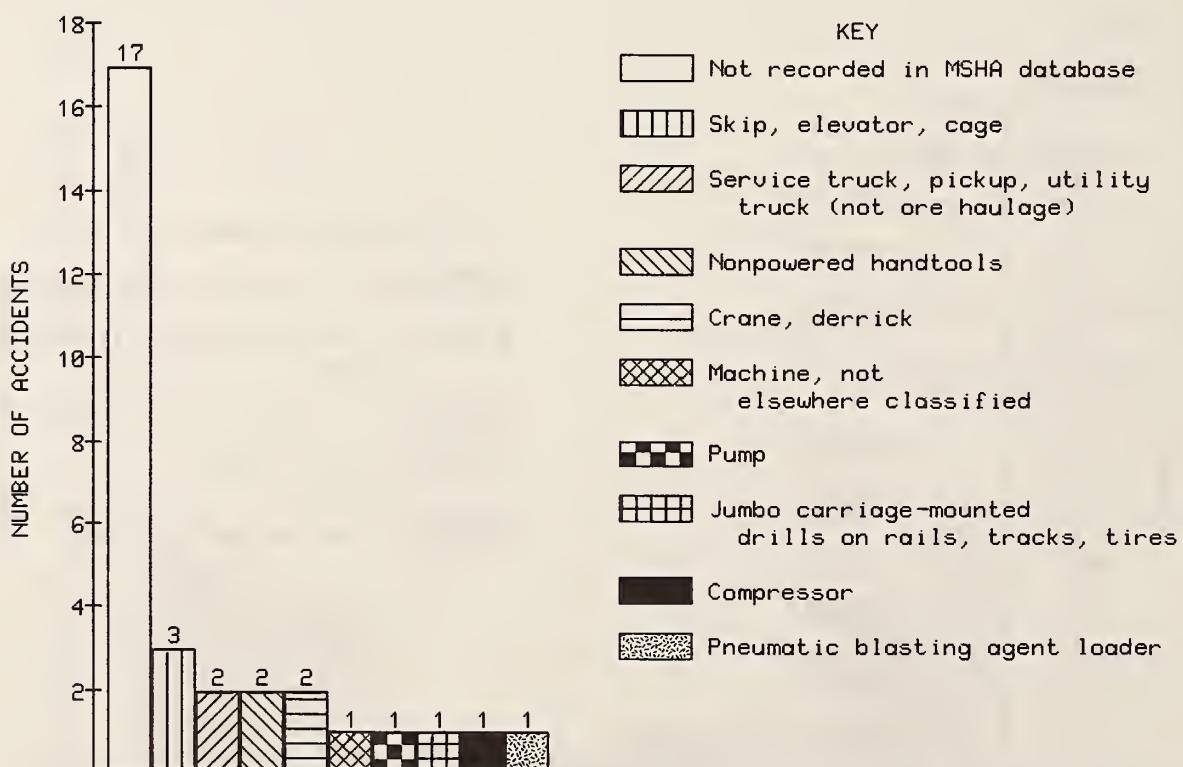


Figure B-6.-Nonfatal electrical accidents at the surface at underground metal-nonmetal mines, 1980-85-Continued.
Machine.

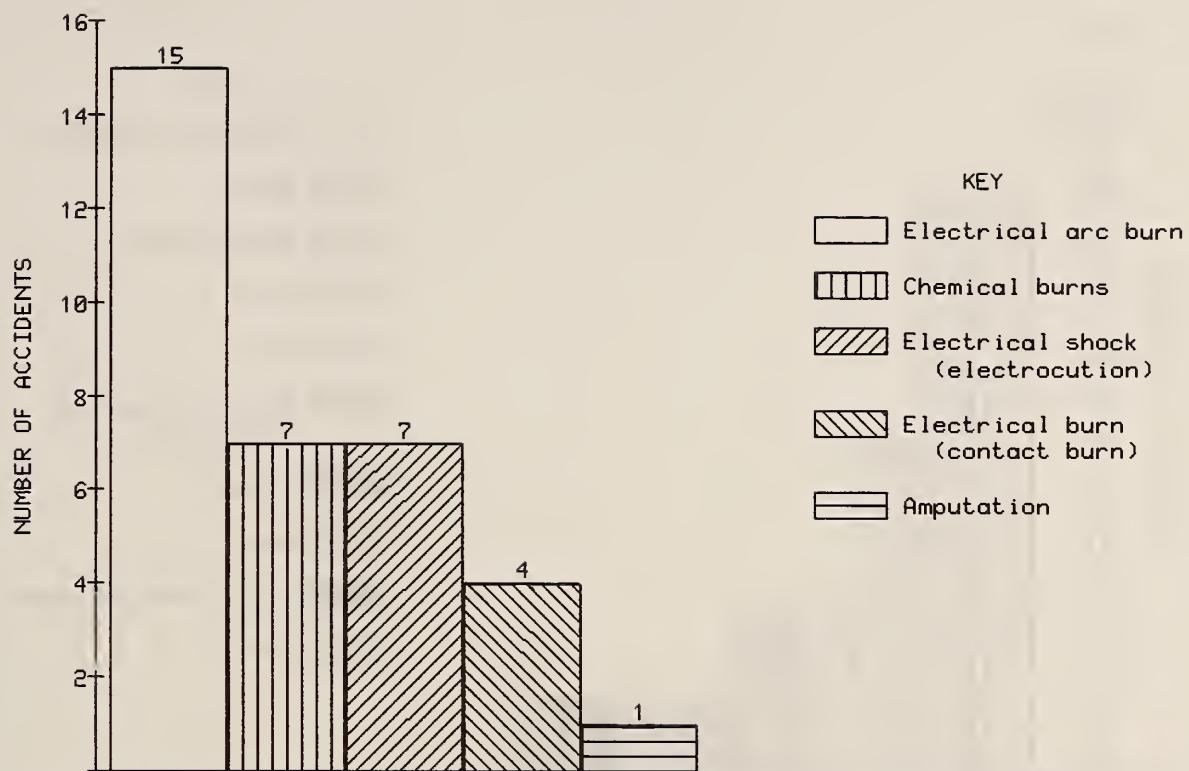


Figure B-6.-Nonfatal electrical accidents at the surface at underground metal-nonmetal mines, 1980-85—Continued.
Nature of injury.

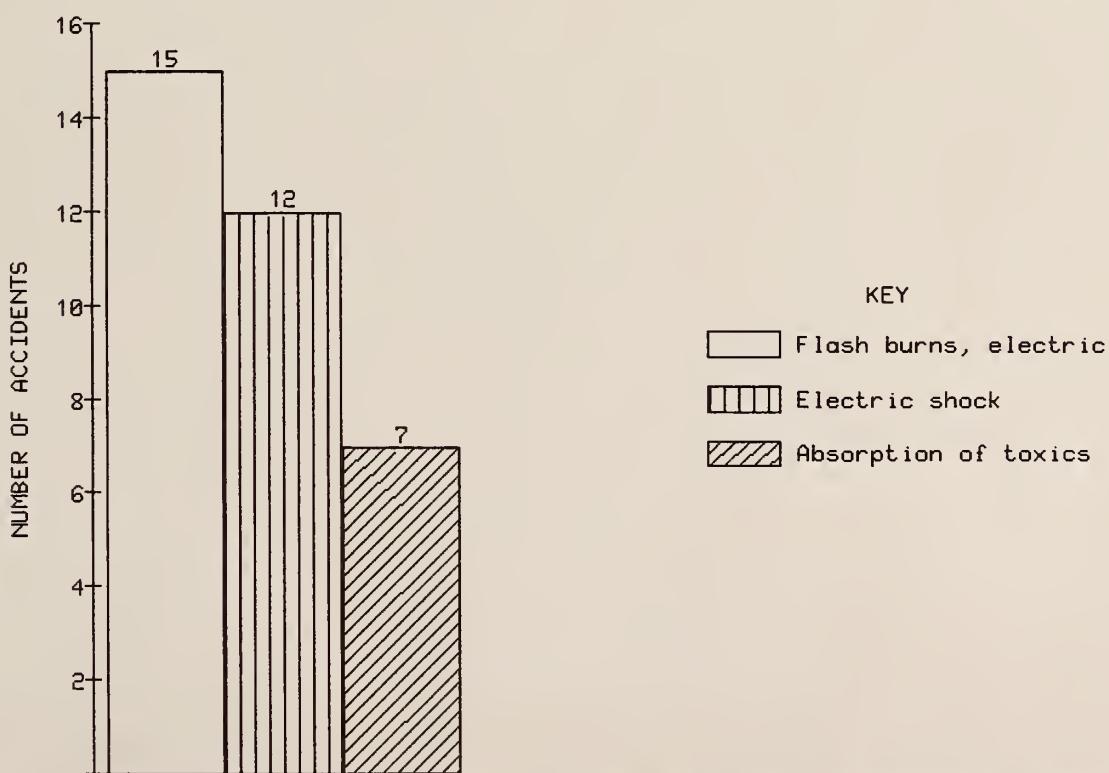


Figure B-6.-Nonfatal electrical accidents at the surface at underground metal-nonmetal mines,
1980-85—Continued. Accident type.

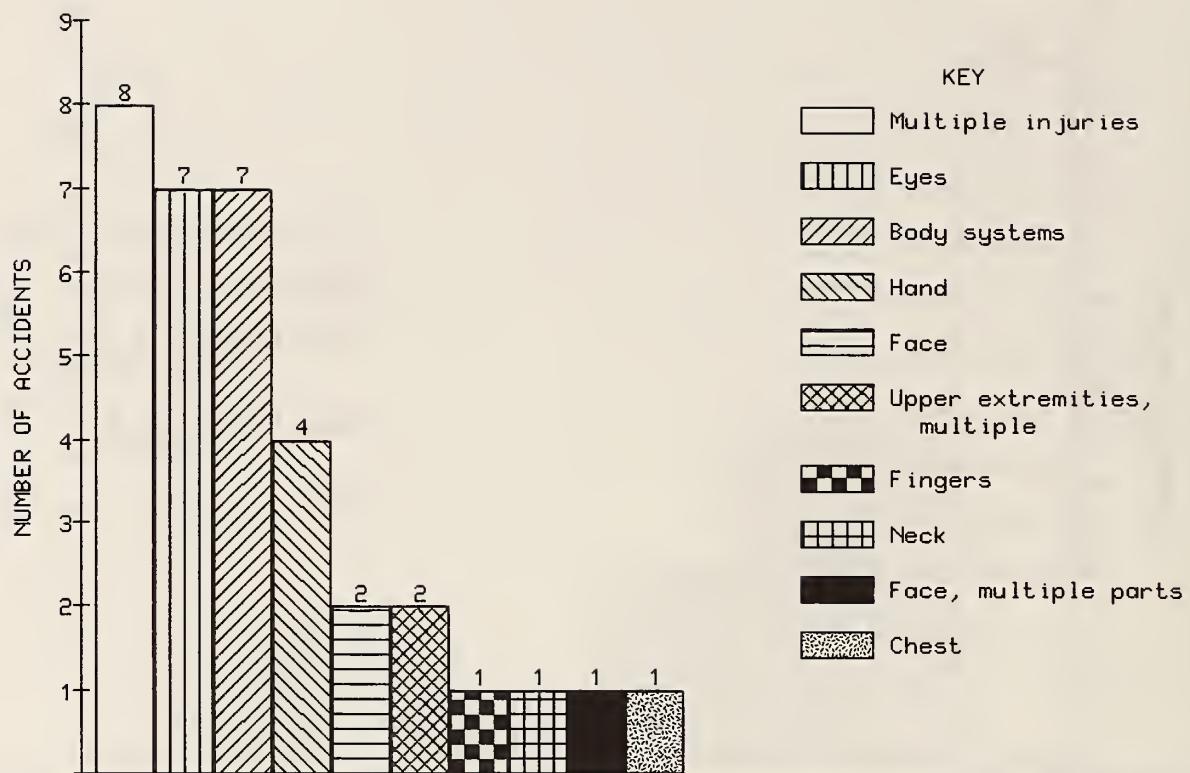


Figure B-6.—Nonfatal electrical accidents at the surface at underground metal-nonmetal mines, 1980-85—Continued.
Part of body.

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